

02-10-00

PATENT

Atty. Docket No. 8552-2 CON III

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Assistant Commissioner for Patents  
Washington, D.C. 20231

APPLICATION FEE TRANSMITTAL

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): Joseph C. Haddad

For: AN INTERACTIVE AUDIOVISUAL DISTRIBUTION SYSTEM

**This application is a:**

☒ Continuation

☐ Continuation-In-Part (CIP)

☐ Divisional

of co-pending U.S. application Serial No. 09/054,020  
filed on April 2, 1998.

CERTIFICATION UNDER 37 C.F.R. § 1.10

I hereby certify that this Application transmittal and the documents referred to as enclosed are being deposited with the United States Postal Service on this date February 9, 2000 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL433927941US addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.

Frank Chau

(Type or print name of person mailing paper)

(Signature of person mailing paper)

**Enclosed are:**

- ☒ 37 page(s) of specification
- ☒ 1 page(s) of Abstract
- ☒ 2 page(s) of claims
- ☒ 16 sheets of drawings ☒ formal ☐ informal
- ☒ 2 page(s) of Declaration and Power of Attorney
- ☐ An Assignment of the invention to:
- 

☐ Certified copy of applications

<u>Country</u>	<u>Appln. No.</u>	<u>Filed</u>
<hr/>		

from which priority under Title 35 United States Code, § 119 is claimed

☐ is enclosed.

☐ will follow.

**Additional papers enclosed:**

- ☐ Preliminary Amendment
- ☒ Information Disclosure Statement
- ☒ Form PTO-1449 (References submitted with parent application)
- ☐ Other

# Fee Calculation (37 C.F.R. §1.16)

For	Number Filed	Number Extra	Rate	Basic Fee \$690.00
Total				
Claims*	1 - 20 = 0		x \$ 18.00	\$ 0
Independent				
Claims	1 - 3 = 0		x \$ 78.00	\$
Multiple	[ ] yes	Add'l. Fee	\$260.00	\$
Dependent				
Claims	[ ] no	Add'l. Fee	None	= \$
TOTAL				<u>\$690.00</u>

[X] Verified Statement of "Small Entity" Status Under 37 C.F.R. § 1.27 [X] is enclosed, [X] was filed in parent application Serial No. 08/668,379 filed June 21, 1996. Reduced fees under 37 C.F.R. § 1.9(f) (50% of total) paid herewith \$345.00.

[ ] A check in the amount of \$    .00 is enclosed for recording the attached Assignment.

[X] A check in the amount of \$345.00 to cover the filing fee is attached.

[ ] Charge fee to Deposit Account No. 50-0679. Order No. \_\_\_\_\_  
TWO (2) COPIES OF THIS SHEET ARE ENCLOSED.

\* Includes all independent and single dependent claims and all claims referred to in multiple claims. See 37 C.F.R. § 1.75(c).

[X] Please charge any deficiency as well as any other fee(s) which may become due under 37 C.F.R. § 1.16 and/or 1.17 at any time during the pendency of this application, or credit any overpayment of such fee(s) to Deposit Account No. 50-0679. Also, in the event any extensions of time for responding are required for the pending application(s), please treat this paper as a petition to extend the time as required and charge Deposit Account No. 50-0679 therefor. TWO (2) COPIES OF THIS SHEET ARE ENCLOSED.

**Relate Back - 35 U.S.C. § 120**

[X] Amend the specification by inserting before the first line the sentence:

"This is a [X] continuation [ ] continuation-in-part [ ] divisional of copending application Serial No. 09/054,020 filed April 2, 1998."

Date: \_\_\_\_\_

2/9/00

SIGNATURE OF ATTORNEY

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Please type a plus sign (+) inside this box → ☐

PTO/SB/05 (4/98)  
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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	8552-2 CON III
First Inventor or Application Identifier	Joseph C. Haddad
Title	INTERACTIVE AUDIOVISUAL DISTRIBUTION
Express Mail Label No.	EL433927941US

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

- ☒ Fee Transmittal Form (e.g., PTO/SB/17)  
(Submit an original and a duplicate for fee processing)
- ☒ Specification [Total Pages 40]  
(preferred arrangement set forth below)
  - Descriptive title of the invention
  - Cross References to Related Applications
  - Statement Regarding Fed sponsored R & D
  - Reference to Microfiche Appendix
  - Background of the invention
  - Brief Summary of the invention
  - Brief Description of the Drawings (if filed)
  - Detailed Description
  - Claim(s)
  - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 16]
- Oath or Declaration [Total Pages 2]
  - ☒ Newly executed (original or copy)
  - ☐ Copy from a prior application (37 C.F.R. § 1.63(d))  
(for continuation/divisional with Box 16 completed)
    - ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

\* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

ADDRESS TO: Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

- ☐ Microfiche Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
  - ☐ Computer Readable Copy
  - ☐ Paper Copy (identical to computer copy)
  - ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

- ☐ Assignment Papers (cover sheet & document(s))
- ☐ 37 C.F.R. § 3.73(b) Statement (when there is an assignee) ☒ Power of Attorney
- ☐ English Translation Document (if applicable)
- ☒ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
- ☐ Preliminary Amendment
- ☒ Return Receipt Postcard (MPEP 503)  
(Should be specifically itemized)
- \* Small Entity Statement filed in prior application, Status still proper and desired (PTO/SB/09-12)
- ☒ Certified Copy of Priority Document(s) (if foreign priority is claimed)
- ☒ Other: Check in the amount of \$345.00

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: 09 / 054,020  
Prior application information: Examiner V. Srivastava Group / Art Unit: 2711

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

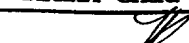
## 17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label

(Insert Customer No. or Attach bar code label here)

or ☐ Correspondence address below

Name	Frank Chau				
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Name (Print/Type)	Frank Chau	Registration No. (Attorney/Agent)	34,136
Signature		Date	2/9/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

Applicant or Patentee: Joseph C. Haddad

Serial or Patent No.: \_\_\_\_\_

Filed or Issued: \_\_\_\_\_

For: INTERACTIVE AUDIOVISUAL DISTRIBUTION SYSTEM

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled:

described in

- ☒ the specification filed herewith.
- ☐ application serial no. \_\_\_\_\_, filed \_\_\_\_\_.
- ☐ patent no. \_\_\_\_\_, issued \_\_\_\_\_.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern, or organization
- ☐ persons, concerns or organizations listed below\*

NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

FULL NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Joseph C. Haddad

Name of inventor

Joseph C. Haddad

Signature of inventor

Date

1/28/00

**AN INTERACTIVE AUDIOVISUAL DISTRIBUTION SYSTEM****CROSS REFERENCE TO RELATED APPLICATIONS**

5 This application is a continuation of U.S. Application Serial Number 08/711,583 filed November 15, 1997, which is a continuation of U.S. Application Serial Number 08/284,846 filed August 2, 1994, now issued as U.S. Patent No. 5,555,441.

**BACKGROUND OF INVENTION****1. Technical Field**

10 The present invention relates to an interactive communication system that allows a plurality of subscribers to access a central audiovisual library, more specifically, a system capable of handling each subscriber's tailored requests for program segments.

**2. Background of Related Art**

15 Systems which provide subscriber access to prerecorded program segments from a distributor center have been described. For example, in a system described in Patent No. 4,521,806 to Abraham, a plurality of subscribers are able independently to access segments of a central  
20 program library. The requested broadcast segments are digitized and time compressed at the central station. They are then delivered to the requesting subscriber only. The time compressed segments are recorded at the subscriber station by a two-speed recorder. When the transmission of the requested segment is complete, a broadcast signal attached to the end of the broadcast segment causes the two-  
25 speed recorder at the subscriber station to playback immediately the transmitted segment. In this system subscriber viewing time is a function of the program  
30 delivery time.

35 In a system described in Patent No. 4,751,684 to Clark et al., each system subscriber is able to request program segments from a distribution center. These segments are then delivered to all subscribers indiscriminately. Subscriber requests to the center are



1 placed in line in the chronological order in which they are received, and are broadcast in turn on one common channel.

U.S. Patent No. 4,963,995 to Lang discloses a video recorder/transmitter apparatus that enables a user to  
5 receive, compress, edit, and retransmit video program information in either compressed or decompressed format. The apparatus includes memory for mass data storage. The patent proposes the linkage of a plurality of the apparatus to a network transfer system, with one apparatus acting as a  
10 distribution center. The above-mentioned U.S. Patent Nos. 4,521,806; 4,751,684; and 4,963,995 are incorporated herein by reference.

Other recent audiovisual delivery systems include pay-per-view (PPV) and video-on-demand. Both systems  
15 offer real time or near instantaneous delivery of subscriber requested video programs in exchange for fees. Both systems emulate an on premise or home video store. But different from a video program rented from a video store, a drawback of these systems is the inability of the subscriber to  
20 manipulate the video program, such as rewind, pause, fast forward, etc., while it is being played or delivered. Further, the fees charged to the subscriber requesting the video program are based on the amount of time the subscriber accesses or is on the system. In contrast, a user who rents  
25 video programs from a video store may choose to access the program as many times and whenever he chooses without incurring further charges.

Therefore, there exists a need for an audiovisual delivery system that is efficient for the program

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1 distributor while accommodating the individual needs of each  
subscriber. More particularly, a system capable of handling  
subscriber requests of several time allowance intervals  
within which program segments will be delivered. The program  
5 distributor accumulates like orders and has the option and  
capability to fill each of these like orders simultaneously.  
The subscriber is subsequently able to manipulate and view  
segments or an entire delivered program.

#### 10 SUMMARY OF THE INVENTION

To achieve these goals the system according to  
the present invention provides for subscribers not only to  
have unlimited access to a program library, but also to  
select variable time allowance intervals for each program  
15 requested. The subscriber is not choosing "yes" or "no" to  
predetermined times of the day for delivery, as in PPV  
systems. Instead, by choosing a variable time allowance  
interval, (s)he is indicating the minimum and maximum amount  
of time (s)he will wait for the deliver of a request, with  
20 those minimums and maximums dependent upon, and beginning  
with, the time that a request is placed.

The system according to the present invention  
allows a plurality of subscribers to select any recorded  
program of a central audiovisual library, without the  
25 constraints of a central broadcast menu preselected by the  
distributor. The system further allows a subscriber to  
receive and store his selection(s), and to view them  
subsequently at any time he chooses. Independent viewing by  
each subscriber is made possible by linking a temporary

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1 storage unit with a microprocessor and keypad at each  
subscriber location. With microprocessor control of the  
temporary storage unit, the system further allows for a  
predetermined amount of time that a program request can be  
5 viewed by a subscriber, that amount to be determined by the  
subscriber or the system distributor.

An object of the system according to the  
present invention is to allow for off-peak delivery of  
requested programs. The present invention addresses the  
10 issues of affordability, efficiency, and subscriber appeal.  
In most audio-visual distribution systems the greatest  
consumer demand occurs in the early evening hours. This peak  
demand taxes the distribution network and may cause  
distributors to limit consumer choices. The present  
15 invention allows the distributor to shift much of the demand  
away from the peak hours without limiting the consumer to a  
pre-set or limited menu of programs.

In the present invention the distributor  
provides the subscriber with several variable time allowance  
20 intervals for delivery of requested programs. For example,  
the distributor can offer "express delivery", that is, within  
one hour; "one day delivery", that is within a twenty-four  
hour period; or "long term delivery", within seven (7) days.  
Each time allowance interval is defined by the maximum amount  
25 of time it will take for the order to be filled. Longer term  
time frames can allow a minimum of time to elapse before  
delivery. For example, the seven (7) day time frame can be  
structured so that the program segments will be delivered  
before the end of seven days, but not before a specified

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1 time, for example, twenty-five(25) hours. In this way, the  
subscriber can anticipate his or her future program  
selections and place them at a much earlier date without  
prematurely burdening his own storage capabilities. The  
5 system of the invention also allows the subscriber to waive  
the minimum time before delivery in those instances where his  
own storage capacity would not be overburdened. If the  
subscriber, for example, chooses a seven (7) day delivery  
service, he can waive the twenty-five (25) hours delivery  
10 minimum and receive delivery anytime within seven (7) days.  
The subscriber will choose which of these time frames meets  
his needs on any given occasion. Product prices will vary  
accordingly. Pricing strategies will encourage distribution  
during off-peak hours and thereby utilize the system hardware  
15 more fully. Not all program segments need to be available  
for each interval.

Another object of the present invention is to  
allow identical orders to accumulate within a given time  
period. The distributor has the option and the capability of  
20 delivering simultaneously all or several requests for the  
same program segment as long as there is some overlapping  
time period for the associated time allowance intervals as  
defined by the various requests. The feature of allowing  
order accumulation provides maximum efficiency and  
25 flexibility for the distributor. The distributor is able to  
use the variability of the time intervals as a basis to  
employ an optimization strategy. The advantages derived from  
the optimization include a lower overall cost.

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1 Still another object of the present invention  
is to provide viewing time independent of transmission  
(delivery) time. The system described herein enables the  
subscriber to order and store one or more program segments.  
5 At any time after transmission, the subscriber can view the  
program segment entirely or in part. The number of viewing  
times may be limited to a predetermined number, except in  
those cases where the subscriber has purchased the program  
segment through the system.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the  
present invention will become more readily apparent from the  
following detailed description of the preferred embodiments  
15 and the accompanying drawings:

Figure 1 illustrates the audiovisual  
distribution system according to the present invention;

Figure 2 shows the major component of the  
distribution center;

20 Figure 3 shows the major components of a  
subscriber terminal;

Figures 4 and 5 are a flow diagram of an order  
processing module;

25 Figure 6 and 7 are a flow diagram of a  
feasibility scheduling module;

Figure 8 is a flow diagram of a delete order  
module;

Figure 9 is a flow diagram of an optimal  
scheduling module;

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1                   Figure 10 is a flow diagram of a transmit  
module;

                  Figure 11 shows flow diagrams for a start-up  
module and receive module;

5                   Figure 12 shows a flow diagram of a request  
module;

                  Figures 13 and 14 show a flow diagram of a  
process order module;

                  Figure 15 is a flow diagram of a select view  
10 module; and

                  Figure 16 is a flow diagram of a view module.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

                  Briefly, the system according to the present  
15 invention preferably utilizes a compressed digital video  
technology to provide for transmission of full motion video  
programs from a central distribution center to individual  
subscribers which are connected over a communication network.

                  The system provides high speed communications,  
20 preferably 1.544 Mbits/sec or higher, to carry video program  
segments from a distribution center 100 to a plurality of  
subscribers 110. The system also provides a low speed bi-  
directional communication link which can be used for  
controlling the video transmission. The system can further  
25 use high speed dial-up transmission with calls to subscribers  
originating from the telephone switching center. Permanently  
connected links are also contemplated.

                  The high speed link 120, is preferably an  
optical fiber link for transmission of program data from the  
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1 distribution center 100. The high speed link 120 may  
broadcast the same data to all subscribers, much the same as  
existing CATV systems. The high speed link may also use  
switching capabilities to facilitate services such as  
5 conferencing. It is apparent to one skilled in the art that  
other known communication techniques including wireless  
communication can be implemented to accomplish the features  
of the delivery system according to the present invention.  
The low speed link 130 is preferably a communication link via  
10 modems and dial-up telephone lines. It provides a duplex  
(two-way) channel for order requests and confirmation. A  
subscriber terminal 140 at each subscriber location is  
configured to receive those programs that have been confirmed  
through the order entry subsystem at the distribution center.  
15 The transmission could be encoded to prevent unauthorized  
reception. Unlike typical computer communication protocols,  
there is no need for the subscriber terminal to acknowledge  
whether a data packet has been received correctly.  
Occasional transmission errors are not critical in full  
20 motion video and would not be objectionable. The high speed  
and the low speed links described above can be combined into  
one link, such as the Bell System ADSL, for communicating the  
aforementioned information via a single bi-directional link.

For order entry processing on the other hand,  
25 the integrity of the transmitted data is extremely important,  
and full two-way handshaking is preferred. The amount of  
data in this case is moderate and relatively low speed. A  
modem speed of 2400 baud is usually sufficient.

1 DISTRIBUTION CENTER

The distribution center 100 performs the following major functions:

- 5 1. Processes the incoming request for a video program from a customer.
  - a) receive incoming calls and establish the (low speed) communication link with a Subscriber Terminal.
  - 10 b) provide authorization for the subscriber to receive and/or make a permanent copy of the program.
2. Schedules the video program segments for transmission and determine whether an incoming order can be delivered at the requested variable time allowance interval.
- 15 3. Controls the transmission of the video program segments.
4. Maintains customer information and billing records.
5. Maintains the library and catalog of 20 video program segments.

The video programs are preferably available in compressed form and stored on an optical disk. Write Once-Read Many (WORM) or CD-Recordable technology can be used, with the disks stored in a jukebox arrangement. Manual 25 intervention may be necessary to assure that the required program disks are loaded in the jukebox as needed.

Video compression techniques are known. Applicable compression techniques for the present invention include DVI (Digital Video Interactive from Intel Corp.) and

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1 the Compressed Digital Video (CDV) technology from  
Compression Labs, Inc. For an average compression ratio of  
about 160:1 for VCR quality moving images, a frame of video  
512x480 pixels x 3 colors (720 KBytes) can be reduced to 5  
5 KBytes/frame. With a 30 frames/sec rate, the compressed  
video requires 150 KB/sec. For a 90 minute (5400 sec) video,  
total storage required is about 810 MB. The CDV technology  
has a somewhat better image quality but requires 1.5  
Mbits/sec (188 KBytes/sec) resulting in a little over 1 BByte  
10 for a 90 minute video. It is anticipated that with MPEG2,  
high quality video could be provided at 3 to 5 Mbits/sec or  
studio quality video at 7 to 10 Mbits/sec.

The system of the invention handles incoming  
orders without interrupting the transmission of the video  
15 programs. The distribution center includes multiple  
processors for video transmission control. Preferably, each  
processor transmits a separate video program. The  
transmission scheme can be by ADSL, with a conference call  
transmitting to multiple subscribers simultaneously.  
20 Alternatively, the several programs can be time-division  
multiplexed onto the optical fiber, providing better  
utilization of the fiber capacity. In either case each  
communication line may be serving subscribers in a particular  
geographic area.

## 25 Order Processing

The Distribution Center includes an order  
processing computer 200 which handles the communication with  
the subscriber terminals over the low speed modem links 130,  
processes incoming orders, and maintains the customer

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1 information/billing data. Authorization to receive a  
particular program or to make a permanent copy of a program  
would be sent back to the subscriber terminals, along with  
any encryption keys, if necessary, to decode the transmitted  
5 program. The order processing computer 200 also determines a  
schedule for transmitting the video programs and notifies the  
transmission control processors 205 what programs to transmit  
and when to transmit them. A display associated with the  
order processing computer alerts an operator to load program  
10 disks into the video library of the appropriate transmission  
control processor.

The order processing computer 200 includes a  
standard hard disk (not shown) for storage of customer  
information and billing data as well as a catalog of video  
15 programs. Depending on the number of subscribers and the  
number of incoming orders anticipated, one or more additional  
processors may be dedicated to handling telephone  
communications and some of the order processing functions to  
off-load the main order processing computer.

20 An interface bus, preferably IEEE-488  
interface bus 215, links the transmission control processors  
to the order processing computer for initiation of a video  
program transmission and passing encryption keys. Several  
transmission control processors can be connected on a single  
25 IEEE-488, and more buses could be added as needed.

#### Video Transmission Control

The primary function of the transmission  
control processors 205 is to retrieve video program data from  
the video library 210, provide encryption or other receiver  
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1 authorization control, and transmit the data over the high  
speed fiber link 120. The process of transmitting a program  
is initiated on command from the scheduling function in the  
order processing computer 200. Several transmission control  
5 processors may be transmitting different video programs at  
the same time using a time-division multiplexing scheme.

The video library 210 includes a set of WORM  
optical disks or CD-Recordable disks that can be loaded into  
a jukebox type disk reader. The memory 215, which may also  
10 be a jukebox, can hold a number of disks and select the  
appropriate one for access. The memory 215 holds over 1300  
gigabytes of data and can be further expanded if necessary.  
Other contemplated storage mediums include magnetic tape  
systems that can automatically select and mount tape reels  
15 from an extremely large archive library. A digital I/O board  
220 is used to output the video data to the fiber optic  
transmitter 230. This board provides for a transfer rate of  
400 KBytes/sec with Direct Memory Access (DMA). At this data  
rate, a 90 minute program can be transmitted in a little over  
20 a half hour using DVI compression technology. The digital  
I/O board may be a PDMA-32 which is commercially available  
from Keithly-Metrabyte, or any substantially equivalent I/O  
board having similar performance characteristics.

The capacity of the fiber optical link is in  
25 the range of 270 Mbits/sec (33 MBytes/sec) to 1Gbit/sec (125  
MBytes/sec). At the lower rate the link is capable of  
handling about 80 different programs simultaneously. Using a  
time division multiplexing scheme, packets from different  
video programs would be intermixed on the fiber link under

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1 control of multiplexing logic circuitry 225 interfacing the  
several transmission control channels to fiber optic  
transmitter 230. At the subscriber terminals, similar  
demultiplexing logic circuitry would identify those packets  
5 that a particular terminal was authorized to receive and  
store them in a buffer memory, to be read in via the digital  
I/O board.

The fiber optic transmitter 230 includes an  
optical fiber transmitter/receiver module available from  
10 Force, Inc., model #2666T-SCXX with data bandwidth of 50 Mb/s  
to greater than 1 Gb/s at operating range 10 km to 20 km  
(typical). The module connects to an Advanced Micro Devices  
TAXI chip set (AM7968/AM7969) which in turn interfaces to the  
multiplexor 225 described above. The multiplexor 225 can be  
15 custom designed using the same technology as the TAXI chip  
sets.

#### SUBSCRIBER TERMINAL

The major components of a subscriber terminal  
20 110 are shown in Figure 3. A receiver 310 is connected to  
the fiber optic link 120 for receiving the high speed optical  
transmissions from the Distribution Center 100. The receiver  
310 includes a photodiode for detecting the transmitted  
optical data and converting the optical data to electrical  
25 signals. A detector such as a Model #2666R-SCXX, available  
from Force, Inc., is preferably used. The receiver 310 also  
includes signal conditioning circuitry for reshaping the  
detected signals. An AM 7969 TAXI chip, available from  
Advanced Micro Devices, is preferably used.

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1 A demultiplexer/decoder 320 demultiplexes the  
received signals previously multiplexed by multiplexor 225 of  
the Distribution Center 100 and digital I/O board 330  
interfaces the demultiplexed data to the video and data  
5 distribution circuitry, which includes a terminal processor  
340, a video processor module 350 and memory 360. The  
terminal processor 340 is preferably a personal computer (PC)  
which includes associated display, modified keyboard  
(keypad), hard disk memory, and/or WORM or CD-recordable  
10 memory. The terminal processor 340 is also connected to  
telephone link 130 through modem 370 for communicating with  
the Distribution Center 100 including requesting and  
receiving authorization for selected program segment orders.

Video processor 350 decompresses the video  
15 data received from the digital I/O 330 and provides Red-  
Green-Blue (RGB) video outputs and Hifi/stereo audio outputs.  
The video processor 350 may be an Action Media 750 available  
from Intel. The compressed video program data may be stored  
on one or more magnetic hard disks for temporary storage and  
20 a WORM or CD-Recordable disk for a permanent copy. If more  
than one hard disk is used, a previously received program  
could be viewed at the same time that a second program is  
being received. To store three 90 minute video programs in  
temporary storage, approximately 2.2 GBytes of memory are  
25 required.

As an alternative to temporary storage of  
video programs at the subscriber terminal, a pool of hard  
disks located at the Distribution Center could provide real  
time transmission. These disks would receive program

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1 segments from the transmission control processors as  
requested by subscribers.

Order entry may be selected through a menu  
driven process using the PC keyboard and monitor. With this  
5 approach the keypad would only need a set of number keys plus  
an ENTER key. The subscriber terminal 110 dials up the  
distribution center 100 to process orders and to receive the  
authorization codes and/or encryption keys to receive the  
program. The program would be stored on the magnetic disk,  
10 and if authorization for permanent copy is received, it would  
be copied to the WORM optical disk as convenient. Programs  
could be copied from temporary to permanent storage only when  
authorization is received from the order processing system.

#### DISTRIBUTION CENTER SOFTWARE

15 The software architecture for the Distribution  
Center includes five primary processing modules and  
preferably five databases. The processing modules are  
loosely coupled and operate on an event-driven basis. They  
perform the following general functions of: (1) Order  
20 processing - processes the incoming request from a customer;  
(2) Scheduling - schedules the video program segments for  
transmission; (3) Transmit - controls the transmission of  
the video program segments; (4) Customer  
maintenance/billing - maintains customer information and  
25 billing records; and (5) Library maintenance - maintain the  
library and catalog of video program segments.

The databases are organized as follows:

1. Library - contains the currently  
available video program segments in compressed format ready

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1 for transmission. Each video program segment may be  
contained on a separate WORM or CD-ROM disk arranged in a  
jukebox type format.

2. Catalog - list of current titles in the  
5 Library database, including pointers to the corresponding  
library disk volume. For each entry, it contains the program  
length, the price schedule for the various classes of  
service, and recent statistics on customer demand (for use in  
optimizing the transmission schedule).

10 3. Customer - contains customer information  
and billing records plus passwords and other information  
needed to authenticate customer identity on receipt of a  
dial-in request.

15 4. Orders - current list of customer orders  
to be delivered. Identifies the customer by a key into the  
Customer database and the video segment by a key into the  
Catalog database.

20 5. Schedule - current schedule of video  
program segments to be transmitted. This database further  
includes:

a) Feasible schedule - used to determine  
whether a requested delivery is possible.  
It is organized by time slot and has each  
video segment delivered at the last  
possible moment to satisfy requested  
variable time allowance intervals.

b) Optimal schedule - an optimized schedule,  
organized by hardware delivery channel,  
showing the video segment currently being

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transmitted (including start/end times, etc.) and the next segment scheduled on that channel.

Each entry includes receiver authorization codes and keys into the Orders and Catalog databases. A description of each module follows.

### Order Processing

The Order Processing module provides the interface by which the customer enters a request for a video program segment. A representative flowchart of the order processing module is shown in Figures 4 and 5 as follows:

On receiving an incoming phone call over a modem (405), the call is answered and a NewOrder data object is created (405) for processing this call. Note that several instances of these data objects may exist at the same time as simultaneous incoming requests are processed. The following functions are performed for each NewOrder data object.

a) Validate the customer by retrieving the customer ID information (410) and checking information in the Customer database (415) and save the key into that database. If the customer cannot be validated (420), send sign off message and terminate call (430).

b) If this customer has an outstanding order (435, 445), prompt over the modem phone link whether an existing order is to be changed or a new order is to be entered (450). If an order is to be changed (455), prompt for the changes interactively and process them (steps 460 to 490). For any changes in variable time allowance interval, the Scheduling module must be called to update the Feasible

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1 Schedule (470) and, if a higher variable time allowance interval is requested, to determine whether the delivery is feasible.

5 c) Prompt the customer for a new order by interactively presenting the list of titles from the Catalog database, along with ordering instructions and pricing (510). If the customer enters an order (515), save the key into the Catalog database for that video program segment and proceed to the next step. Otherwise, go to confirmation and sign off  
10 routine(s).

d) Invoke the Scheduling module to verify whether the video program segment can be scheduled in the variable time allowance interval that the customer requested. The Feasible Schedule is also updated at this time (520).

15 e) If the program segment cannot be scheduled for the requested variable time allowance interval, notify the customer of the highest variable time allowance interval that can be scheduled and ask whether that is acceptable (525, 530). If not acceptable (535), invoke the  
20 Scheduling module to delete this order from the Feasible Schedule and go back to step 510 above.

f) Confirmation and sign off routine (545) - send the order confirmation, if any, to the subscriber terminal. This includes the receiver authorization code to  
25 allow receipt of the transmission when it occurs and codes to determine how long or how many times the video program segment may be viewed before it is automatically erased. A confirmation message is displayed to the customer (550). Send the authorization codes (555). Preferably, each

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1 customer is assigned a unique identification number and at  
the beginning of each program segment, the ID is transmitted  
in a data block along with the authorization code and/or  
decryption code. This technique provides the flexibility to  
5 change the mix of customers to receive a particular  
transmission up to the time the program is actually  
transmitted.

g) Send sign off message to subscriber  
terminal and hang up the phone (560).

10 h) Order processing complete. Delete the  
NewOrder data object and go to step 400 to wait for a new  
incoming call.

#### Scheduling

15 The Scheduling module has two primary  
functions: (1) Feasibility - to quickly determine whether  
it is possible to satisfy a customer's request for a  
particular video segment at a certain variable time allowance  
interval so that a pending order can be accepted or rejected.  
20 This function is invoked from the Order Processing module  
whenever a new order or a change to an order is received; and  
(2) Optimization - uses a rule based approach to select the  
next program segment to transmit over a channel when the  
channel becomes free. The technique optimizes the delivery  
25 of video segments that have been ordered to efficiently  
utilize the available hardware channels while meeting  
variable time allowance interval requirements. This function  
is invoked just before a hardware channel is to finish  
transmission of a video segment so that the selection can be

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1 made from the current list of orders. For example, orders  
for the same program segment having overlapping time  
allowance intervals can be accumulated and accessed at the  
appropriate delivery time so that the delivery to the  
5 requested subscribers can be substantially simultaneous or  
broadcasted.

For continually processing new orders without  
interrupting the optimal schedule, each function maintains a  
separate schedule for its own use as described under Schedule  
10 Database section.

The variable time allowance interval may  
include a minimum delivery time which determines the earliest  
time that the program segment is to be available for viewing.  
This is accomplished through the authorization codes, which  
15 tell the subscriber terminal when viewing is permitted. The  
actual transmission may occur early; however, such early  
transmission should only be allowed when a subscriber  
indicates that he has sufficient memory to receive the  
program. If desired, the customer could be made aware that  
20 the program segment is available before the minimum waiting  
period and that an order could be processed to authorize  
immediate viewing.

When the Feasibility function is invoked, it  
receives the following information from the Order Processing  
25 module:

- Keys into the Orders and Catalog databases
- Program length
- variable time allowance interval requested

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1           If the system is split geographically with a  
separate link(s) for each area, the link that serves each  
customer must be identified in the Customer database, and the  
schedule must contain two parts: the schedules for the  
5 communication lines and the schedules for the transmission  
control channels. If the fiber optic link is not  
geographically split, all subscriber terminals may receive  
the same transmissions, and the number of control channels  
should equal the number of program segments that can be  
10 multiplexed on the fiber link at any one time.

Alternatively, with high speed dial-up transmission  
capability, each transmission control unit can be connected  
directly to any number of subscriber terminals, and any  
number of control units may be used (limited only by the  
15 number of different program segments in the library). In  
either of these cases only the control channels need to be  
scheduled.

Figures 6 and 7 are program flow diagrams of  
the Feasibility Scheduling process, generally as follows:

20           Determine the latest time that delivery can be  
completed for the requested variable time allowance interval;

          Search existing Feasible Schedule for the  
requested video segment (605);

          If the video segment is found (610) and if the  
25 scheduled time satisfies the requested variable time  
allowance interval (645) (assuming proper link schedule on a  
geographically split system), then return a code to Order  
Processing that the order can be accepted (675). Otherwise

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1 copy the current Feasible Schedule into a tentative working  
schedule (615);

If the video segment is found (610) but the  
scheduling time does not satisfy the requested variable time  
5 allowance interval (645), remove the program segment from the  
schedule (650, 655). For a geographically split system,  
remove the program segment from the tentative schedule for  
the appropriate geographic link;

10 Insert the program segment into the schedule  
at the latest possible time. Maintain the latest time order  
by inserting at the proper location and shifting other  
segments forward if necessary and if possible. When trying  
to insert the program segment into the schedule, check for  
conflict with other program segments for the same customer at  
15 the same time, and, if there is a conflict, insert at the  
latest possible time when there is no conflict (620);

If the insertion was successful (625), save  
the tentative schedule as the new Feasible Schedule (660) and  
return a code that the order can be accepted (680);

20 Otherwise if there is no lower variable time  
allowance interval (630), delete the tentative schedule (665)  
and return a code that the offer must be rejected (685);

If a lower variable time allowance interval  
exists, lower the variable time allowance interval, and try  
25 to insert the segment into the schedule (635);

If successful, save the tentative schedule as  
the new Feasible Schedule (640, 670) and return (690),  
indicating the highest variable time allowance interval than  
can be scheduled. Otherwise, go back to step 630.

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1 For a geographically split fiber link system,  
the insert program segment routine (steps 620, 635) is  
expanded as shown in Figure 7, to first schedule (705, 710)  
the link and then the channel (715 to 730) so that  
5 coordination between different links can be effected.

Figure 8 is the flow process when the  
Feasibility function is invoked by the OrderProcessing module  
to delete an order from the Feasible Schedule. The process  
include:

10 Search the Orders database for other orders of  
this same video segment (805).

If no other order exists (810), then remove  
the video segment from the Feasible Schedule (815, 820).

If the order exists, get the latest delivery  
15 time for the new segment and move segment later in the  
schedule if possible (825, 830).

Return to the calling program (835).

The Optimization function is invoked (via a  
timer scheduled by the Transmit module) just before a  
20 hardware channel completes delivery of its video segment.  
Sufficient time is allowed so that the optimization can be  
completed. The function may also be invoked if the Transmit  
module finds that the schedule needs to be reoptimized before  
initiating the transmission of a video segment. This  
25 function selects only the next video segment to be  
transmitted for each hardware channel. It is not practical  
to try to optimize the complete schedule since new orders  
would require it to be continually reoptimized.

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Referring to Figure 9, the first step in the processing is to calculate the slack time for each program segment in the Feasible Schedule (905). The slack time is the time remaining before a program segment must be started to just meet its required delivery. It can be obtained directly from the Feasible Schedule; however, if there were a conflict in scheduling two or more program segments at the same time for any customer, then the minimum slack time over all of the conflicting programs is used as the slack time for each of those programs. Next retrieve estimates of the rates at which orders are expected to be placed for each program segment at this day and time, including estimates for express deliveries. These rate estimates can be computed off-line based on recent statistics. The selection of the segment to schedule for next transmission is based on the following factors: (1) Slack time for each program segment to be scheduled; (2) Estimated rate of arrival of orders for each program segment to be scheduled; (3) Estimated rate of arrival of orders for new program segments; (4) Estimated rate of arrival of express orders for new program segments; (5) How much free time is there in the Feasible Schedule; (6) Current channel status, including when each will become free; and (7) If any of the customers receiving a transmission have other program segments on order and, if so, when their current transmission is scheduled to be complete. The selection of which segment is to be transmitted next on a particular open channel is made by applying a set of rules to compute a weight for each segment. This weight ranges from 0 to 1, and the segment with the highest weight is selected for

1 transmission (930). A weight is also computed for the  
channel to remain idle for a specified time period. The  
rules for computing the weights are listed below. Weights  
from the different rules are combined in the manner used to  
5 combine certainty factors as described in Rule Based Expert  
Systems: The MYCIN Experiments of the Stanford Heuristic  
Programming Project, B.G. Buchanan and E.H. Shortliffe, Eds.,  
Addison-wesley, Reading, MA, 1984, pp. 272-280. The  
descriptions in these pages are incorporated by reference  
10 herein.

1. For each segment find how many channels  
will complete their current transmission within the slack  
time. Set the weight for that segment to the reciprocal of  
that number (910). If the number is one for any segment  
15 (915), select that segment immediately and return (920, 955).  
If there is more than one such segment, choose the one that  
is to be transmitted to the most customers.

2. For each segment, add a small amount of  
weight inversely proportional to the estimated arrival rate  
20 of orders (925). For the idle channel weight use the rate of  
arrival of new program orders.

3. Add a small amount of weight to each  
segment, proportional to the expected arrival rate of new  
orders up to a preset limit (925). This is to encourage the  
25 transmission of existing orders so that channels will be free  
later to handle new orders.

4. Combine a small amount of negative weight  
proportional to estimated arrival rate of new express orders  
up to a preset limit. Add proportional weight to the idle  
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1 channel weight. The basis for the weight in this case is  
moderate if there is a large amount of free time in the  
Feasible Schedule; otherwise, it is small. The large or  
small decision can be made by applying fuzzy logic. This  
5 rule is to encourage leaving some channels free to handle  
express orders. The program segment with the highest weight  
is selected (930) and checked against the list of program  
segments currently being transmitted (935). If there is a  
conflict, the program segment with the next highest weight is  
10 selected (940).

If a channel is to remain idle by the  
application of these rules (945), a timer is set to poll that  
channel again in about 10 or 15 minutes (945, 950). The  
amount of weight to be added in applying these rules (small,  
15 moderate, etc.) is for a small weight to be preferably around  
0.1 and a moderate weight to be around 0.3. The weights  
could be updated as operating experience has gained. For  
example, if the rate of arrival of express orders is less  
than what has been experienced, the idle channel weight would  
20 be reduced.

For the geographically split system, the rules  
should be applied to the Feasible Schedules for both the  
channels and the links. An additional rule for coordinating  
more than one link with a channel would be that once a  
25 segment is selected for transmission on a particular link,  
see if it is also needed on other links. If so, then wait  
for those links to become available if the wait is not too  
long and if it doesn't violate the slack time for other  
segments on the new link.

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## 1 Transmit

The Transmit module controls the actual transmission of the video program segment. It uses the Optimal Schedule to determine which segment to transmit over a particular hardware channel (steps 1000 to 1045). Keys obtained from the Optimal Schedule (1015) point into the Orders and Catalogue databases, which in turn contain keys into Customer and Library. When transmission of the program segment is complete, the corresponding entries in the Optimal and Feasible Schedules (1050) are deleted and all appropriate Customer records are updated to indicate that delivery has been made (1020, 1035). When transmission of a new video segment is initiated, a timer is set to start up the Optimization Scheduling function (1060) just before delivery is scheduled to complete.

## Library Maintenance

This module (not shown) is used to add or remove available program segments to or from the Library and update the corresponding entry in the Catalog. It is initiated by operator selection from the main system menu.

## Customer Maintenance/Billing

This module (not shown) is initiated by operator selection from the main system menu. There are two main functional areas that are involved:

- 25           - Update of all user information including that need to authenticate customer identity.
- Generate customer bills from the record of program segment deliveries in the Customer database.

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1 Implementation of this module is readily apparent to an  
ordinarily skilled programmer.

#### SUBSCRIBER TERMINAL SOFTWARE

Through the PC keyboard and monitor at the  
5 subscriber terminal, order entry and program viewing are  
controlled using a menu selection approach in which a set of  
options are displayed on the monitor and the customer enters  
his choice via the keypad. This technique is similar to that  
currently used for programming a VCR. The keypad need only  
10 have a set of numeric keys (0-9) and an ENTER key. If  
desired a BACKSPACE key could be added to allow for  
correction of a miskey before ENTERing the selection.

When the customer wishes to make a request,  
for example to place or modify an order or to view a program  
15 segment which he has already received, he presses the ENTER  
key. The system responds by displaying a menu on the video  
screen and waits for the customer to enter a response through  
the keypad by pressing the numeric keys that correspond to  
the desired menu selection and then pressing ENTER. If a  
20 program segment was being viewed on the monitor when the  
ENTER key was pressed, that program pauses until the customer  
is finished with the menu selections. On return from the  
menus, the customer has the option to resume viewing the  
program, to stop viewing, or to select a different program.

25 The Subscriber Terminal subsystem is driven by  
two types of events which generate hardware interrupts: 1) a  
key being pressed on the keypad and 2) the communications  
hardware recognizing the start of a video program segment  
being transmitted over the communication line. Keypad events

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1 are handled by the Request module or by a standard keyboard  
processing routine, depending on the state of the system.  
The communications event invokes the Receive module, which is  
responsible for getting the incoming program segment off the  
5 communication line and storing it to disk. The Receive  
module can run in the background in a multi-tasking mode  
while other processes such as order entry, program viewing,  
or making a permanent copy are in progress.

The Subscriber Terminal software system  
10 consists of seven modules, some of which are subroutines  
called from the other modules.

Referring to Figure 11, the Start up- module,  
which is run when the system is first powered up (1100),  
retrieves receive authorization codes (1105) and initializes  
15 the communications hardware (1110) and then sets up the  
interrupt processors for the keypad and the communications  
hardware (steps 1115, 1120).

The receive module is invoked by an interrupt  
from the communications hardware on the start of transmission  
20 of a new program segment (1130). The module first checks  
whether this Subscriber Terminal has been authorized (1135,  
1140) (through the Process Order module) to receive the  
program segment. If so, the module grabs the incoming blocks  
of program data from the communication line and stores them  
25 to disk (steps 1145, 1155 and 1160). The module continues to  
run in the background (at high priority) in a multi-tasking  
mode until all blocks of the program segment have been  
received. Alternatively, the authorization code may be  
transmitted to the subscriber terminal as described in the

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1 Distribution Center Order Processing module. In that case,  
the Receive module examines the list of customers in the  
first block of a program segment to see if it is authorized  
to receive that program. If so, the authorization code that  
5 is sent with that block is extracted to identify which of the  
subsequent blocks belong to that program segment.

Referring to Figure 12, the request module,  
which handles all customer requests which are entered through  
the key pad (steps 1205, 1210, 1215). First, if a program  
10 segment is being viewed, it notifies the View module to pause  
(1220, 1225). It then displays some basic menus to ask the  
customer whether he wants to process an order or to view or  
stop viewing a program segment (steps 1230, 1235, 1240,  
1245). Depending on the response, it calls the ProcessOrders  
15 (1295) or the SelectView subroutines (1265), each of which  
presents more menu selections. A more complete description  
of this module is given below.

The ProcessOrders routine is shown in Figures  
13 and 14. This subroutine is called by the Request module  
20 or by the SelectView subroutine to interactively communicate  
with the distribution center. Subscriber orders or requests  
for extension of viewing time or number can be made through  
this routine. The subscriber dials up the Distribution  
Center and interfaces with the Order Processing module  
25 (1305). The menus that are displayed by this module are  
preferably at the Distribution Center and passed as messages  
over the low speed communication link 130. Upon receipt and  
verification of the subscriber or customer ID information  
(1325, 1335), the distribution center sends a menu packet to

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1 the subscriber (1340). These menus include lists of  
available programs, programs currently ordered but not yet  
delivered, pricing information, etc. The customer enters his  
response from the keypad and transmits that response back to  
5 the Distribution Center (1355). If an order is placed or an  
existing order is changed, the authorization codes are sent  
to the Subscriber Terminal. A more complete description of  
the module is given below.

The SelectView module is shown in Figure 15.

10 This subroutine is called by the Request module to allow the  
customer to select for viewing any one of the programs  
segments that are available on the hard drive or the WORM  
drive at the subscriber terminal. If the selected program  
segment has expired (either date/time or number of plays), it  
15 asks the customer whether the order should be extended. If  
so, it calls the ProcessOrders subroutine so that  
authorization can be obtained from the Distribution Center.  
Otherwise, it asks if the program segment is to be deleted to  
free up disk space. Note that an expired program is not  
20 immediately deleted even though it cannot be viewed. This  
allows the customer to extend his authorization without the  
necessity of retransmitting the program segment. As an  
alternative implementation, the list of available programs  
could include those that have been received but not yet  
25 authorized for viewing because of the minimum wait time for  
the selected variable time allowance interval. The customer  
could be prompted to process an order to receive  
authorization for immediate viewing.

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1           The View module is shown in Figure 16. This  
module controls the actual viewing of a program segment. It  
is initiated by the Request module after a selection has been  
made using the SelectView subroutine. It may run at the same  
5 time as the Receive module in a multi-tasking mode. A flag  
or semaphore set by the Request module is used to tell the  
View module when to pause in viewing a program. When a pause  
flag is detected, the current program state is saved so that  
viewing may be resumed later if desired. A parameter passed  
10 to the view module identifies whether to resume a program, to  
terminate a program, or to start a program from the  
beginning.

          The Copy module copies a program segment from  
the hard disk to a removable storage medium such as a WORM  
15 disk. It executes in the background in multi-tasking mode at  
a very low priority.

#### Request module

          This module is one of two modules that process  
hardware interrupts from the keypad. When the system is  
20 powered up, the start up module directs that any keypad  
interrupts be processed by the Request module. All keys but  
the ENTER key are ignored at this point, causing the module  
returns immediately. When the ENTER key is pressed, however,  
the module becomes ready to handle a customer request. It  
25 first directs that keypad interrupts be processed by a  
standard keyboard interrupt processor, which places key  
presses in a queue where they may be accessed by standard  
input functions. Next, it checks whether a program segment  
is currently being viewed, and, if so, it sets the flag in  
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1 the View module to tell that module to pause. It then displays a menu on the monitor and waits for a response to be entered via the keypad (using standard input routines). The menu options and subsequent actions are as follows:

5                   1. Stop viewing (1240) (only if a program segment was being viewed)

                  invoke the View module to terminate the current segment (1255). The program then is no longer in the pause state.

10                  2. Resume viewing (1250) (only if a program segment is currently in the pause state)

a) direct the keyboard interrupt processing to invoke this Request module (1280).

b) invoke the View module with "resume" parameter (1282)

15                  c) return (1283)

3. Process a new order (1285) (may be selected at any time)

a) call the ProcessOrder subroutine with "new order parameter" (1295)

20                  b) go back to display a new menu on the video screen (1230)

4. View a new program segment (1245) (only if no program is currently in the pause state)

25                  a) call the SelectView subroutine (1265)

b) direct the keyboard interrupt processing to invoke this Request module (1280)

c) invoke the View module with "begin view" parameter (1282)

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- 1                   d)    return (1283)
5.    Permanent copy - customer has previously  
purchased authorization to copy a program segment to a  
removable storage medium such as a WORM disk (1201, 1202).
- 5                   a)    prompt customer to insert disk, wait for  
                      response (1203)
- b)    invoke the Copy module to copy the  
                      program segment to the removable medium  
                      in a multi-tasking mode at very low  
10                   priority; continue execution of this  
                      module
- c)    go back to display a new menu on the  
                      video screen (1230)
6.    Quit (only if no program is currently in  
15 the pause state)
- a)    direct the keyboard interrupt processing  
                      to invoke this Request module (1280)
- b)    return (1283)

Notice that before returning from this module, the keypad  
20 interrupt processor is set for this Request module.

#### Process orders subroutine

                  This subroutine may be called from the Request  
module or the SelectView subroutine. A parameter is passed  
to indicate where it is called from. The first step is to  
25 dial up the Distribution Center (1305) and establish  
communication with the Order Processing module there. It  
sends the customer identification information (1325),  
including any passwords if desired, and tells whether to  
process a new order (where this subroutine was called by the  
30

1 Request module) or an extension to an existing order (where  
this subroutine was called by SelectView). After receiving a  
validation of the customer identification from the  
Distribution Center, it waits for a message packet (1335,  
5 1340). The message options are shown below with the  
corresponding actions taken. All keypad entries are  
processed using standard input routines where a number is  
followed by ENTER.

1. Interactive messages (1345) - these are  
10 the menus constructed by the Distribution Center to be  
displayed on the video screen

- a) display the message and wait for a  
response through the keypad (1350)
- b) transmit the response back to the  
15 Distribution Center (1355)
- c) go back to wait for another message  
packet from the Distribution Center  
(1340)

2. Authorization code for a particular  
20 program segment (1375)

- a) if this is for a new order, add the  
authorization to the list of program  
segments to be received (1390), transmit  
an acknowledgement to the Distribution  
25 Center (1360), and go back to wait for  
another message packet
- b) if this is for an existing order that has  
been placed but not received yet, modify  
the authorization in the list of program  
30

1 segments to be received (1395), transmit  
an acknowledgement to the Distribution  
Center, and go back to wait for another  
message packet:

- 5 c) if this is an extension to the expiration  
status for a program segment already  
received, modify that expiration status  
(1395), transmit an acknowledgement to  
the Distribution Center, and go back to  
10 wait for another message packet

3. Check disk space (1400) - this code tells  
the Subscriber Terminal to verify whether there is sufficient  
disk space to store the requested program segment

- 15 a) If there is sufficient room (1405),  
transmit an acknowledgment to the  
Distribution Center, and go back to wait  
for another message packet (1410)  
b) Otherwise, display a menu with the  
following options and wait for a response  
20 (1415):

i) cancel order (1420)

- transmit a cancel command to the  
Distribution Center (1425)  
- go back to wait for another message  
25 packet

ii) delete file (1430)

- display a list of program segments with  
their size info & expiration status  
30 (1435)

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- wait for response
- if a program is selected (1440), delete it (1445) and go back to check if there is sufficient room; otherwise go back to (b) and redisplay the menu.

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The system according to the invention is not limited to any specific means or methods of data communication between subscriber and distributor. For example, it is readily apparent to one ordinarily skilled in the art that the distribution of programs can take place over CATV lines, fiber optic lines, or any other adaptable data link. Also without substantive changes, the system can be employed whether the method of distribution is a continuous loop, as in conventional CATV systems, or whether the method uses dedicated or private lines, as in conventional telephone system. Regardless of the type of distribution link, the system provides interactive communication between subscriber and distributor, expanded memory for the subscriber, and a archive of time allowance intervals that provides maximum flexibility for the subscriber and maximum efficiency for the distributor.

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CLAIMS:

1. An interactive audiovisual distribution system comprising:
  - A. a distribution center having:
    - a. a library of stored audiovisual programs;
    - b. an order processing computer connected to a plurality of subscriber stations for handling requests for delivery of selected segments of said audiovisual programs from said plurality of subscriber stations, said order processing computer being coupled to a plurality of transmission control processing units for allocating servicing of said requests to said transmission control processing unit; and
    - c. each of said transmission control processing units having:
      - a transmission control processor for receiving commands from said order processing computer and for handling the distribution of said requested selected program segments;
      - a memory for storing audiovisual programs including said requested selected program segments; and
      - an interface for coordinating transfer of said requested program segments to subscriber stations corresponding to said requests; and

B. each of said subscriber stations including:

a receiver for receiving said requested program segments from said distribution center;

a terminal processor having associated memory input device and display for generating said requests for delivery of selected segments of said audiovisual programs from said distribution center and for coordinating transfer of said program segments delivered from said distribution center; and

a video processor for decompressing said program segments in compressed video format.

ABSTRACT

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A distribution center according to the present invention is capable of handling requests from a plurality of subscribers for accessing programs in a central audiovisual library. The subscriber requests may specify a variable time allowance interval within which a requested program may be delivered.

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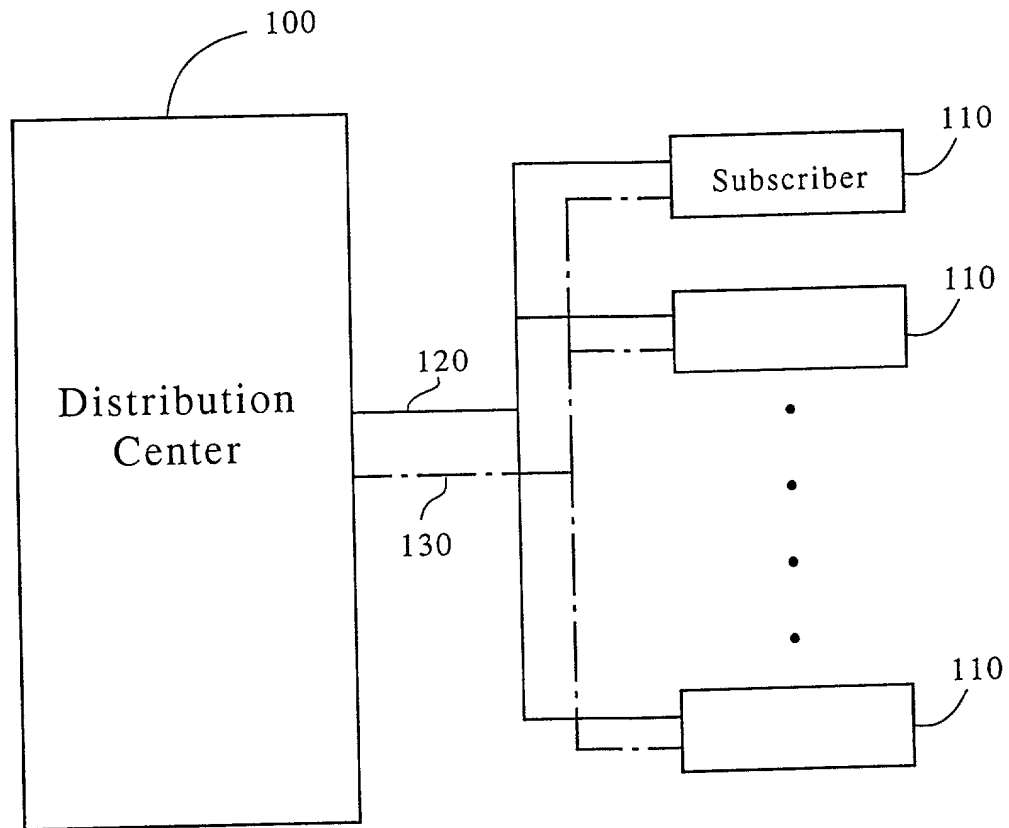
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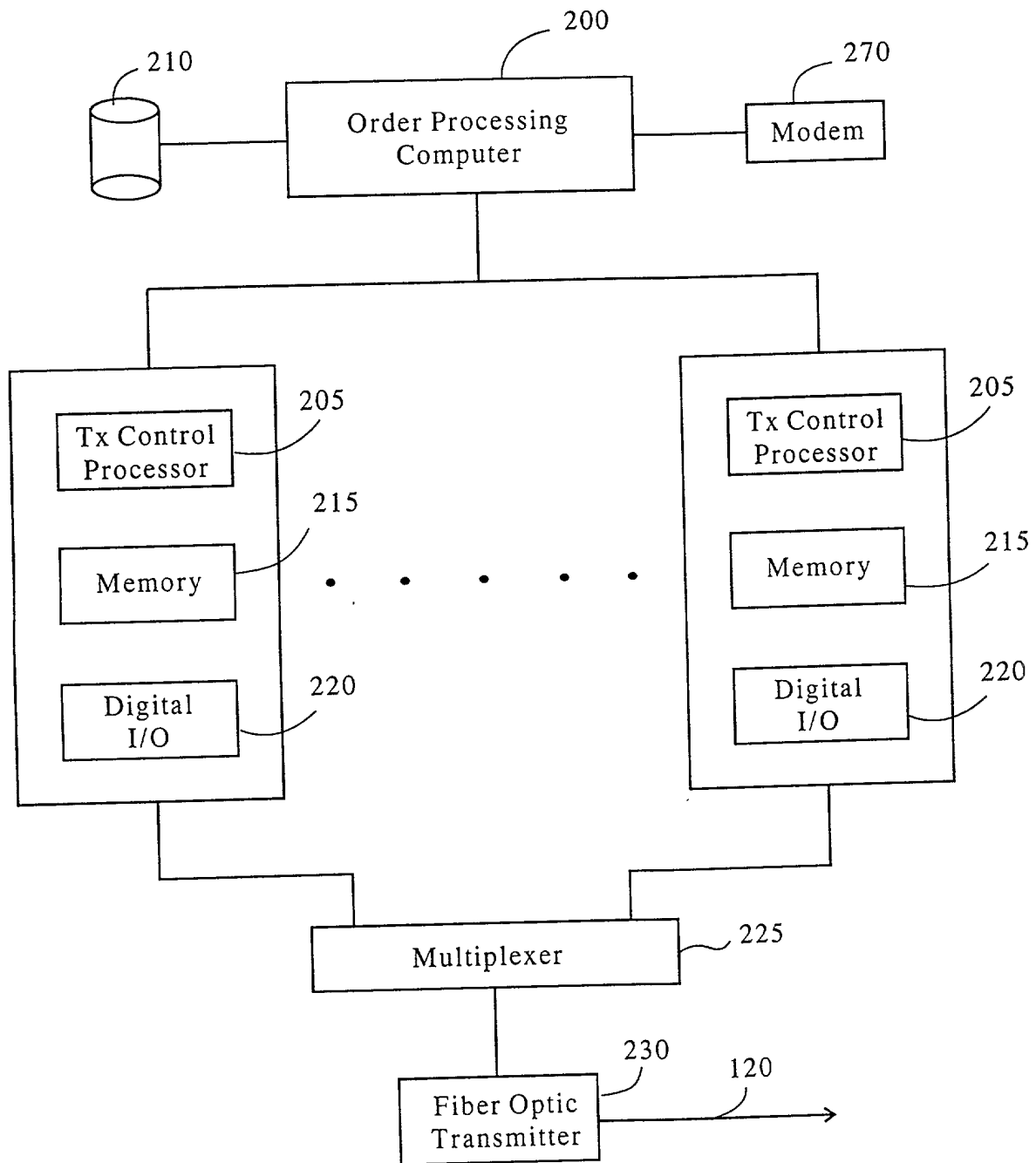
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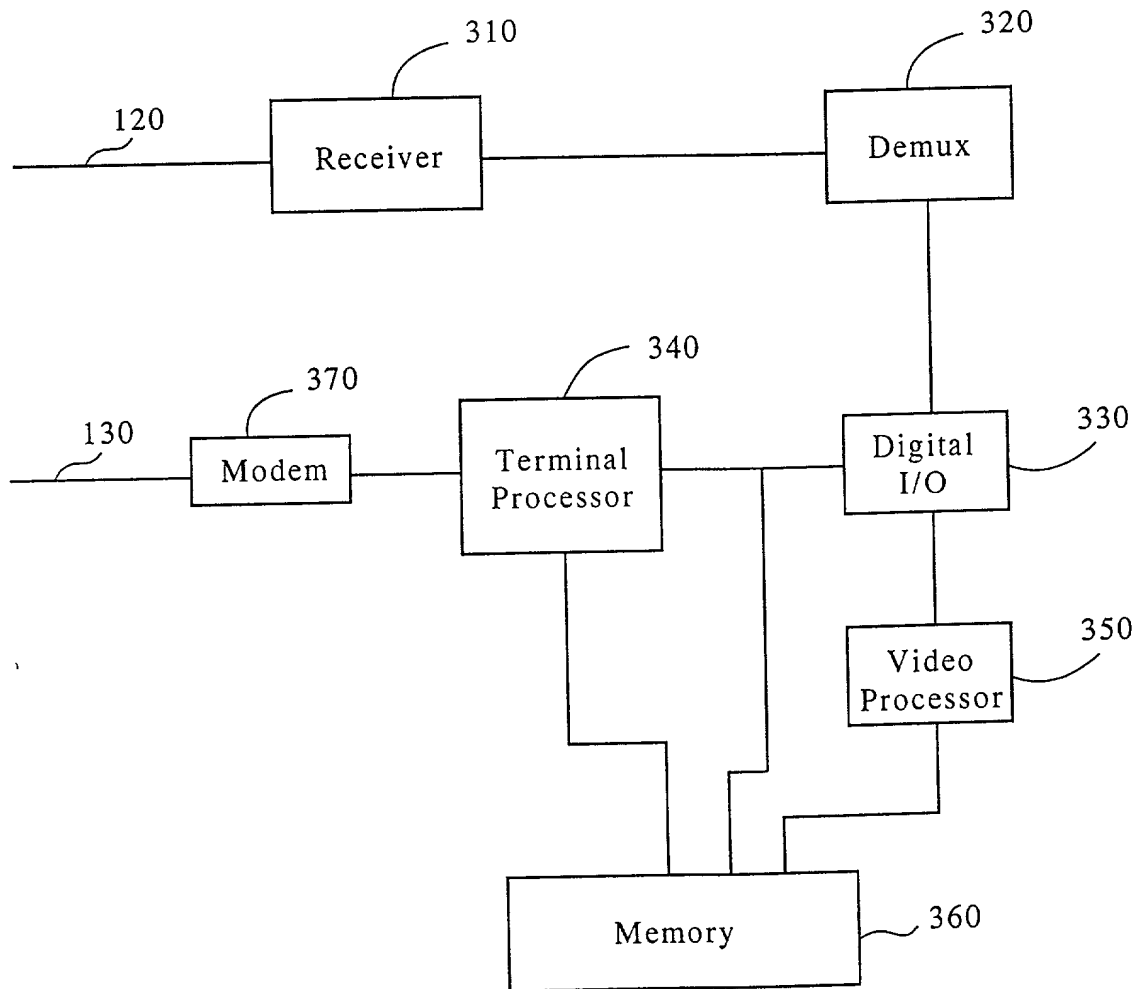
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**FIG. 1**





**FIG. 2**

**FIG. 3**

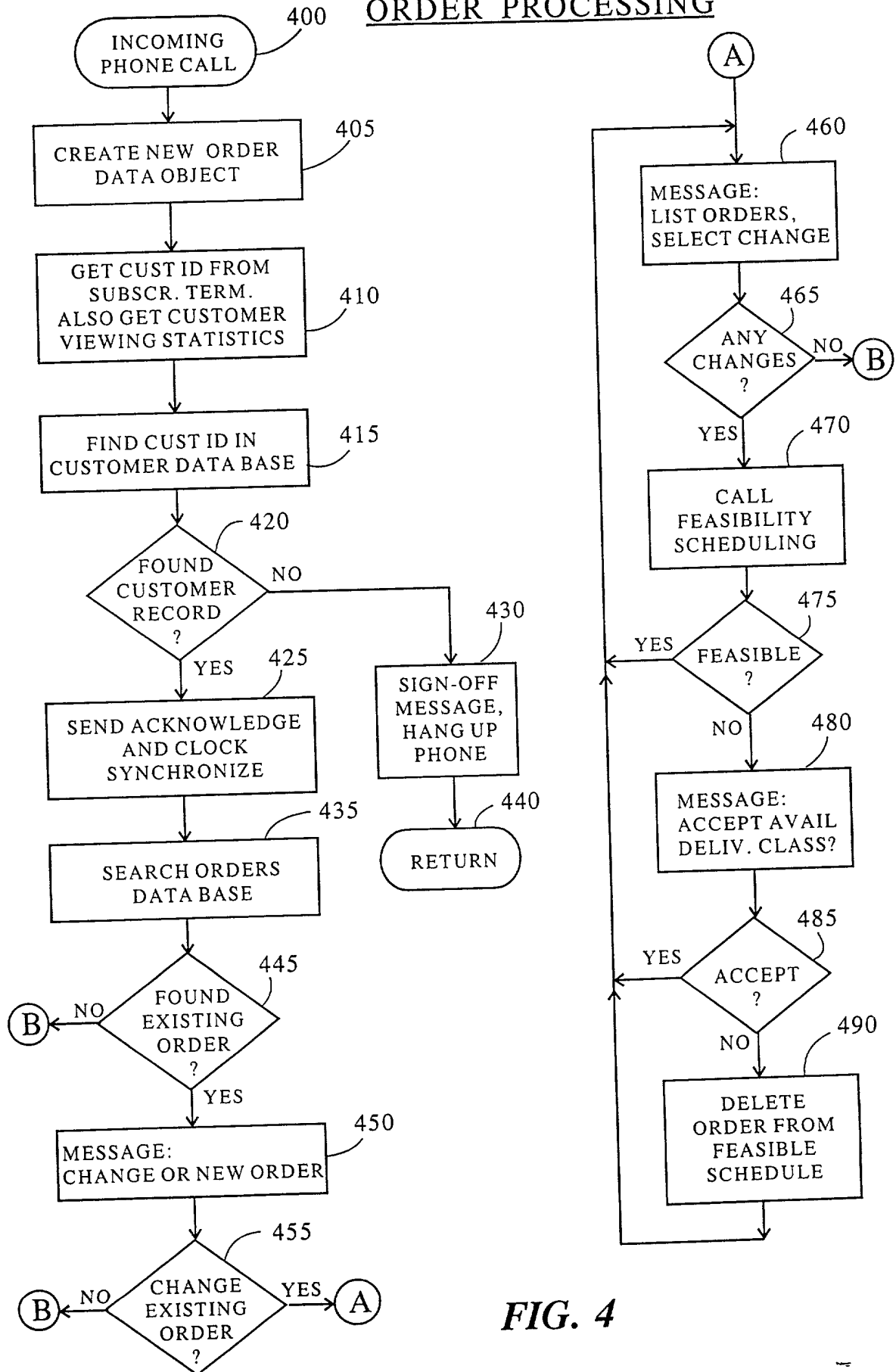
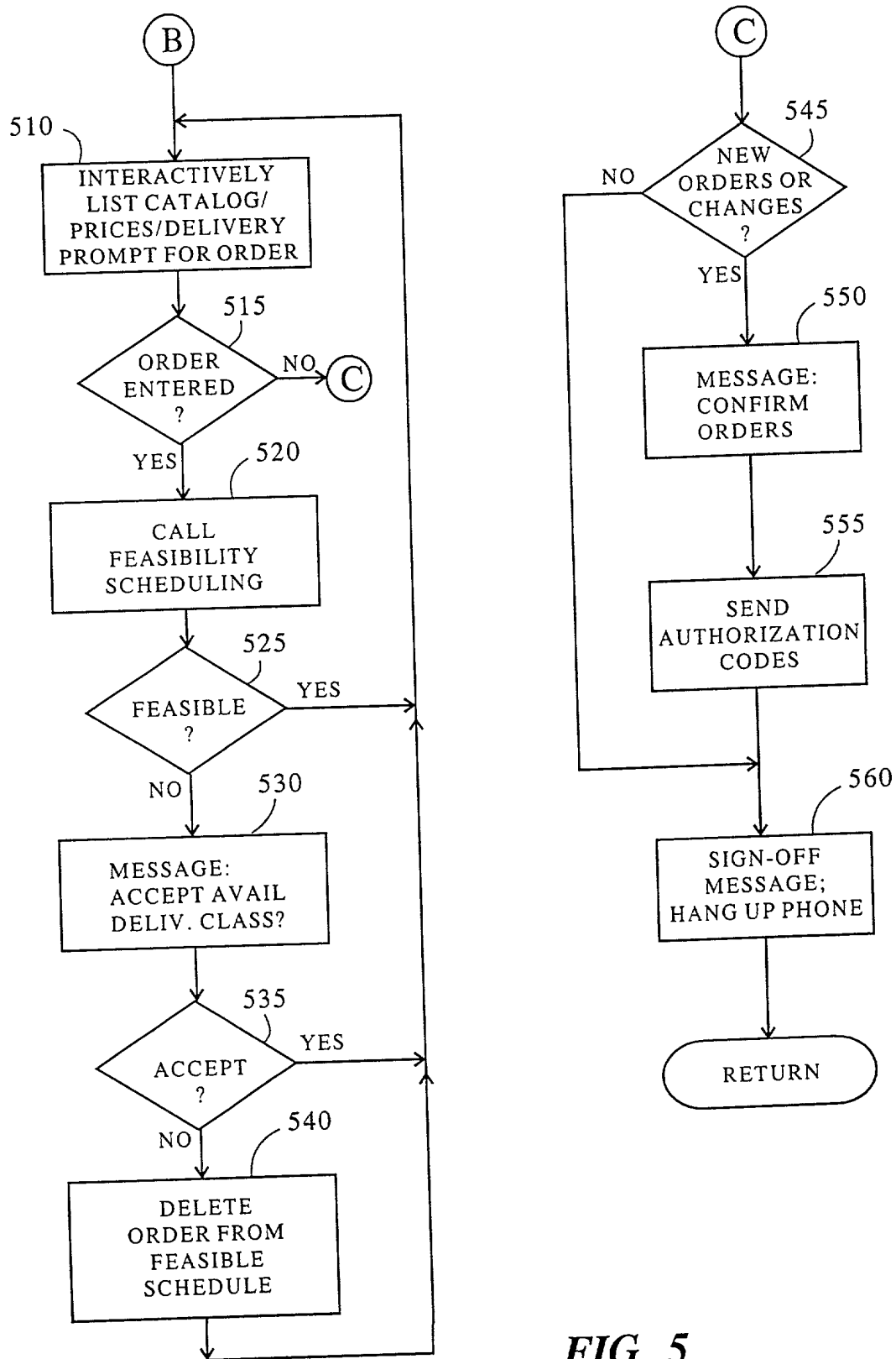
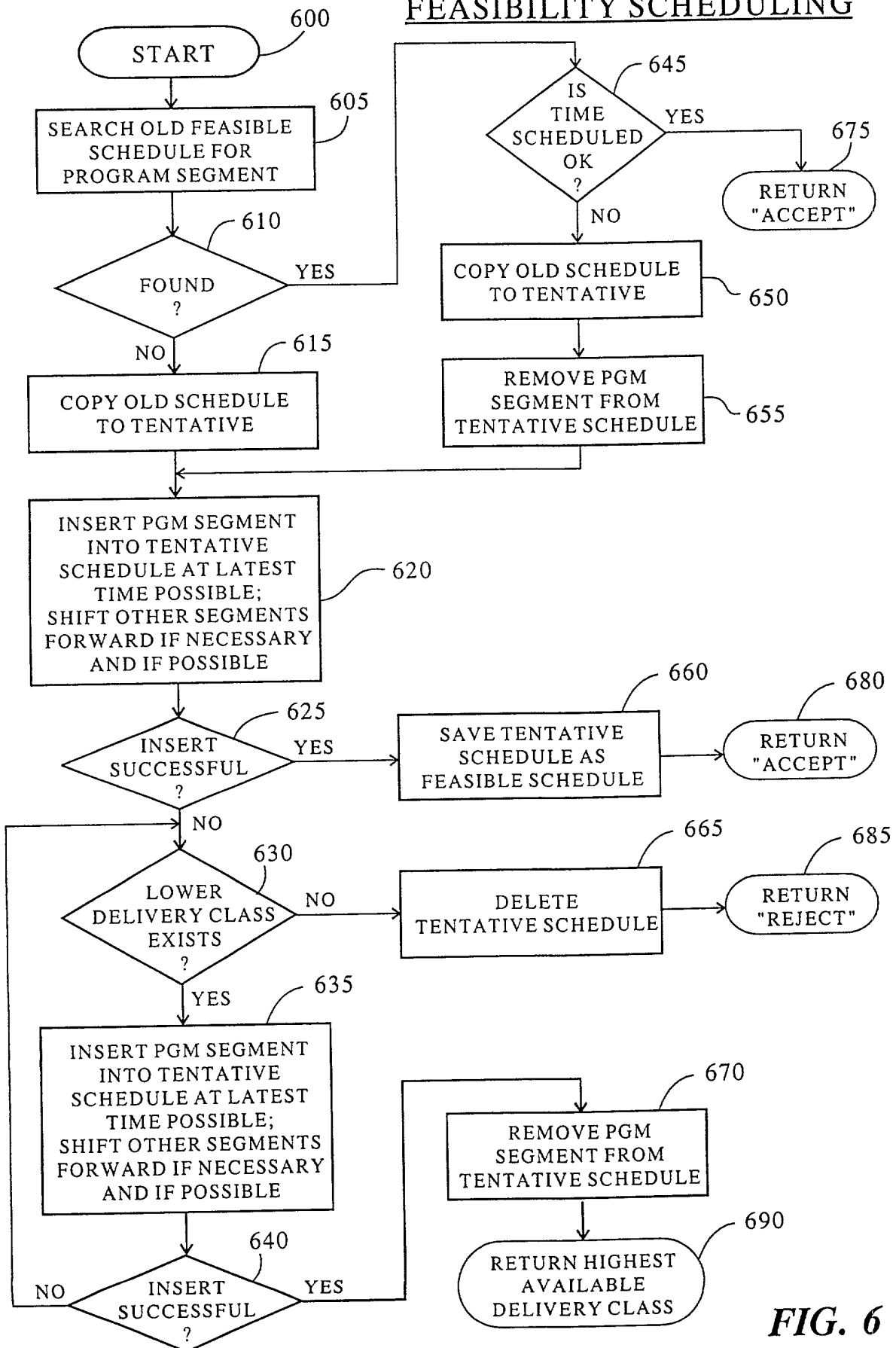
ORDER PROCESSING

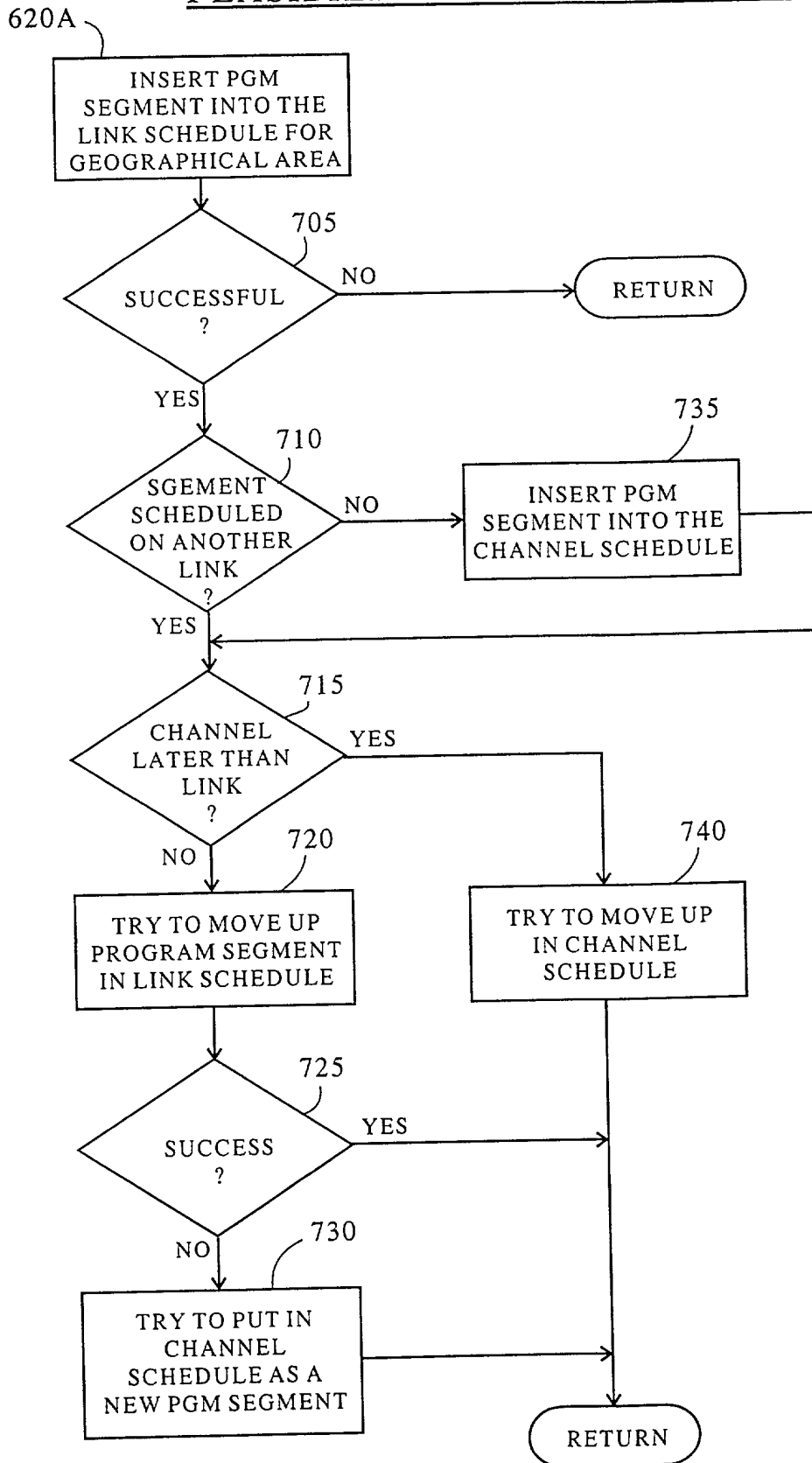
FIG. 4

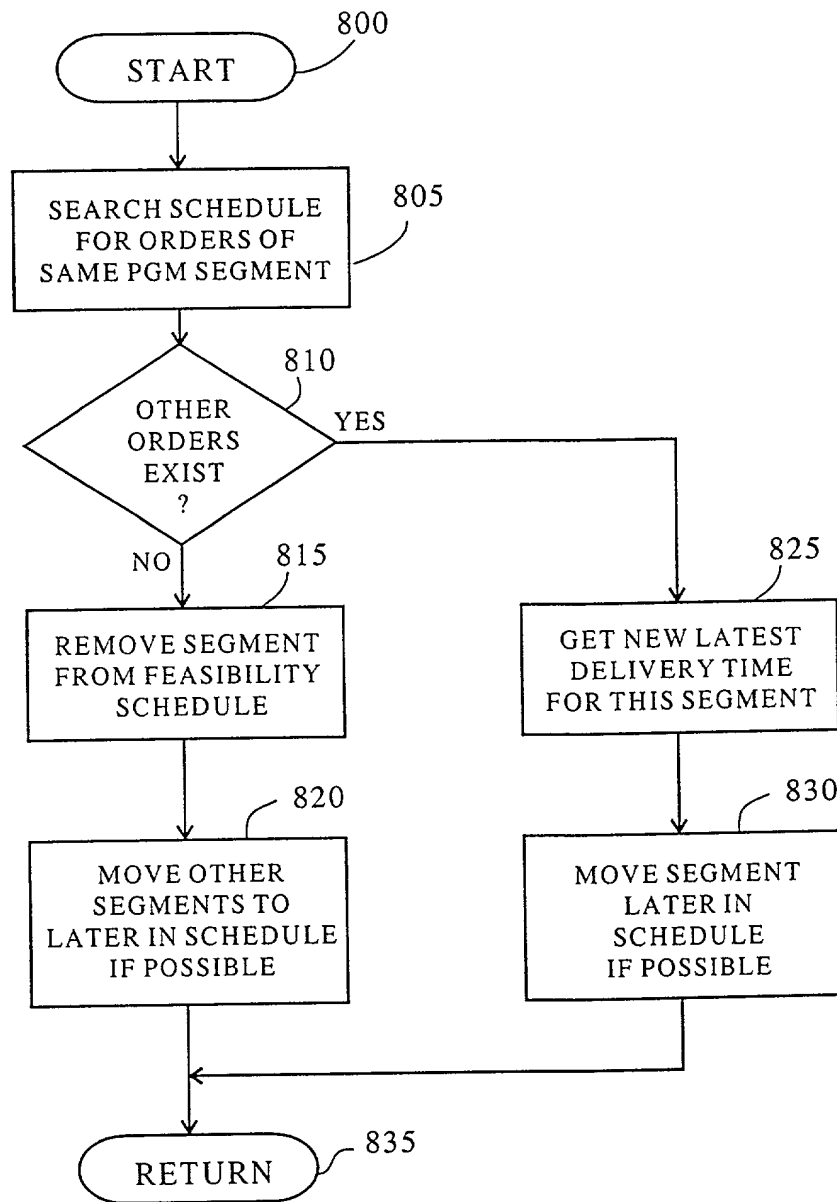
ORDER PROCESSING (CONT.)**FIG. 5**

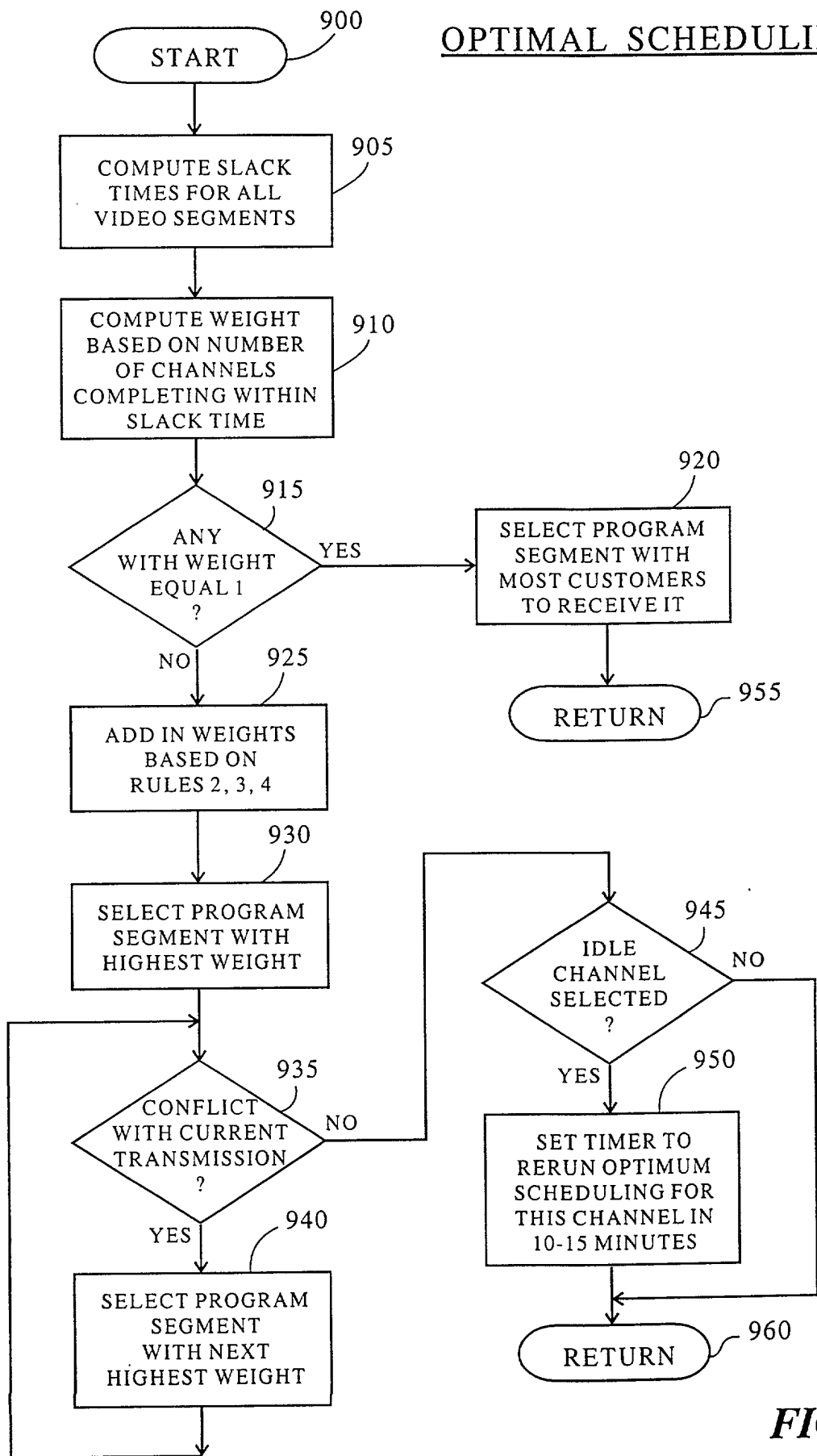
# FEASIBILITY SCHEDULING



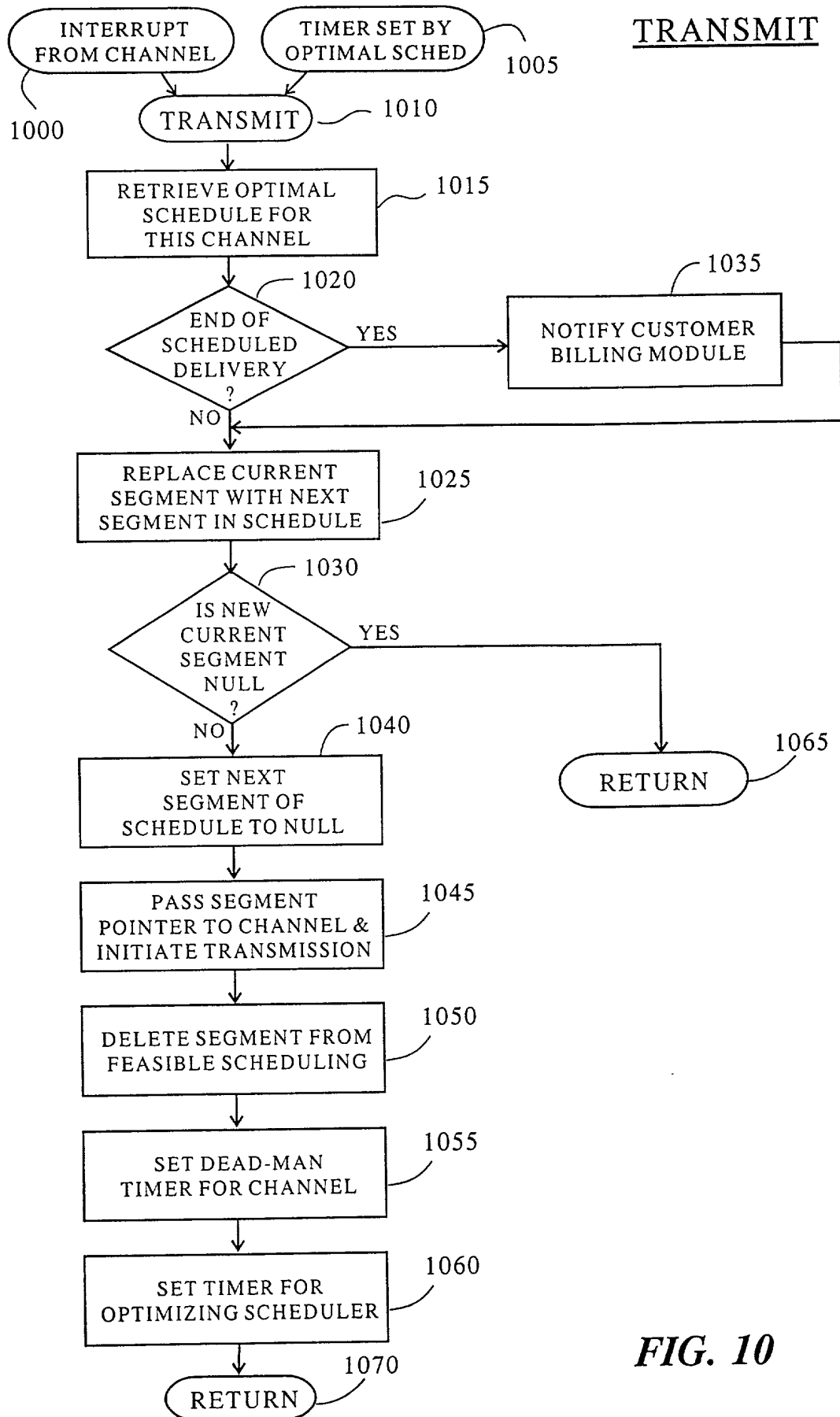
**FIG. 6**

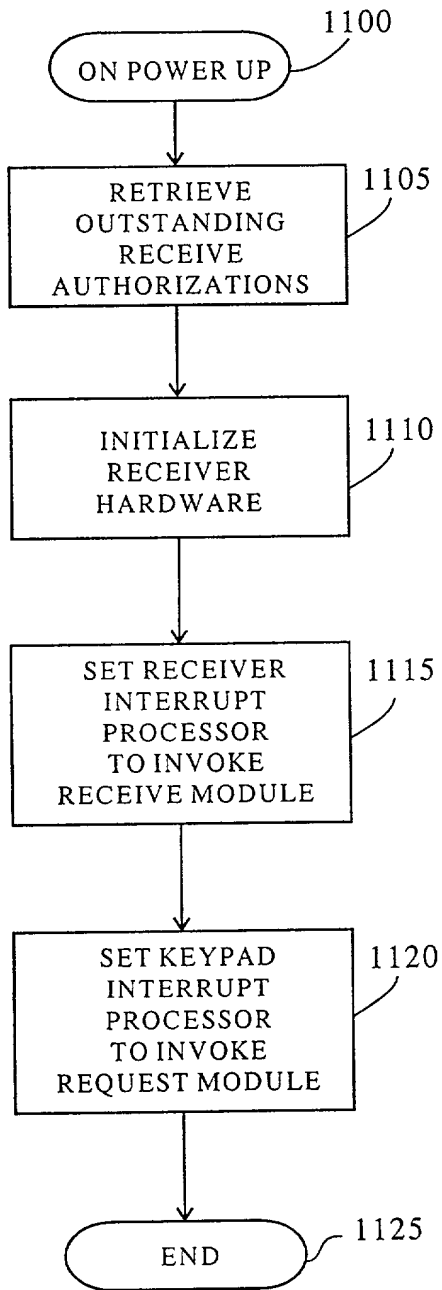
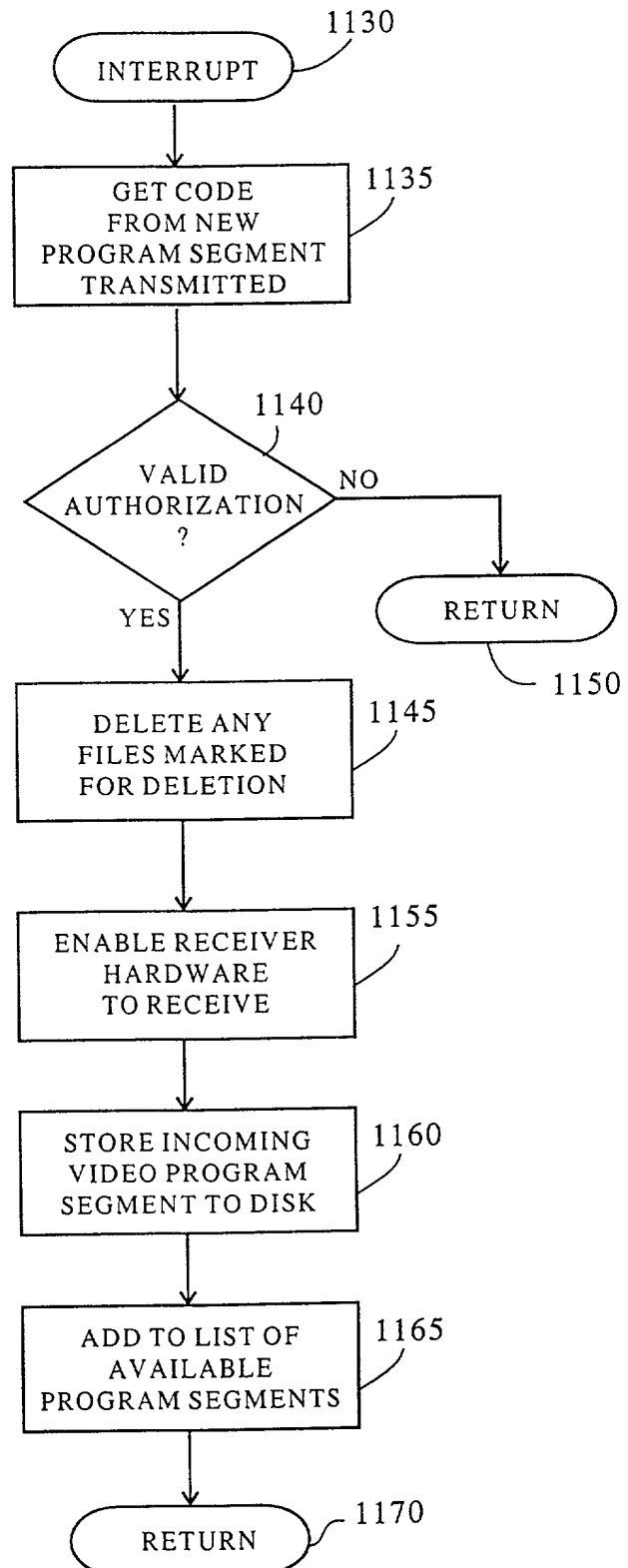
FEASIBILITY SCHEDULING (CONT.)**FIG. 7**

**FIG. 8**

OPTIMAL SCHEDULING**FIG. 9**



**FIG. 10**

START UP MODULERECEIVE MODULE**FIG. 11**

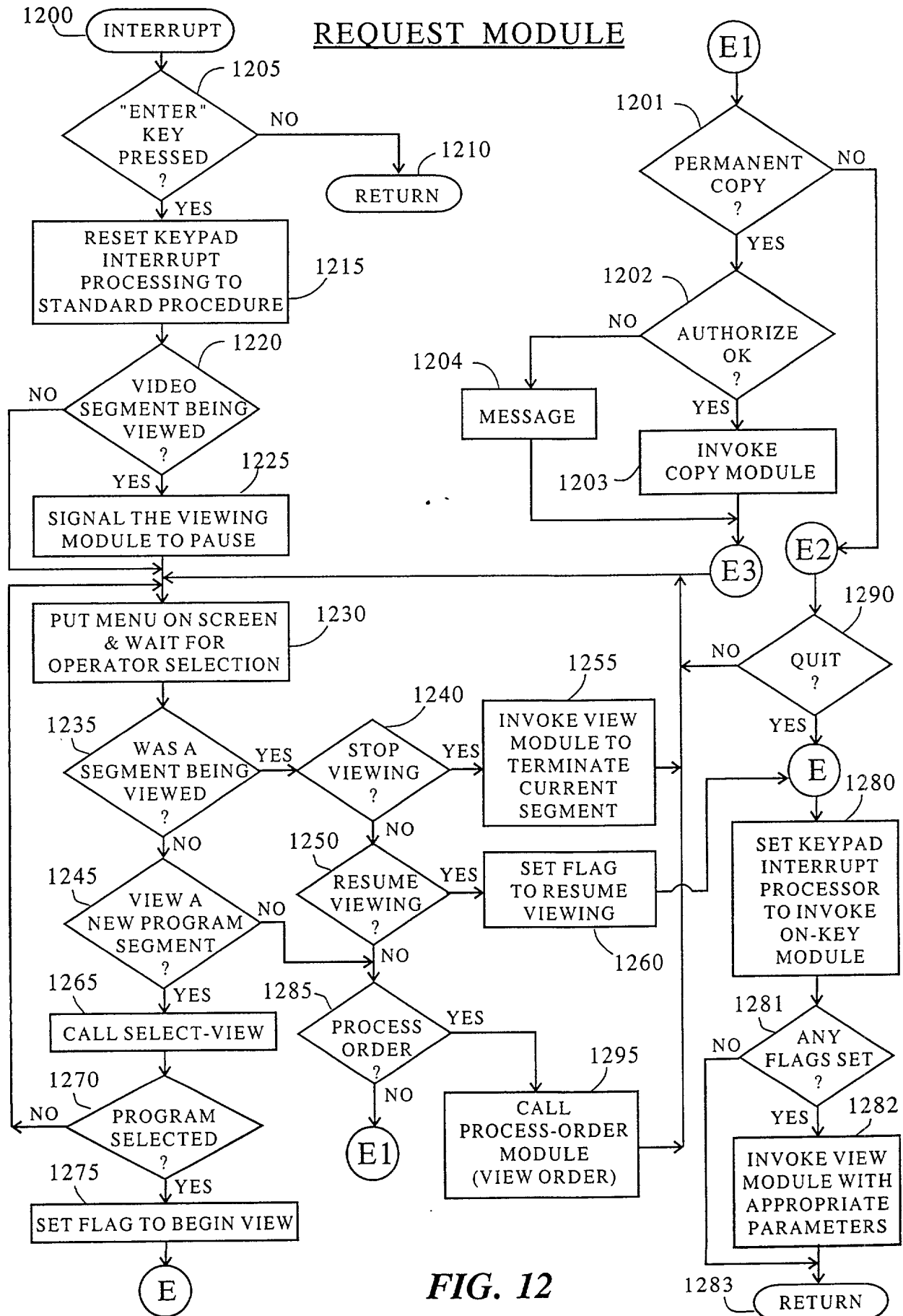
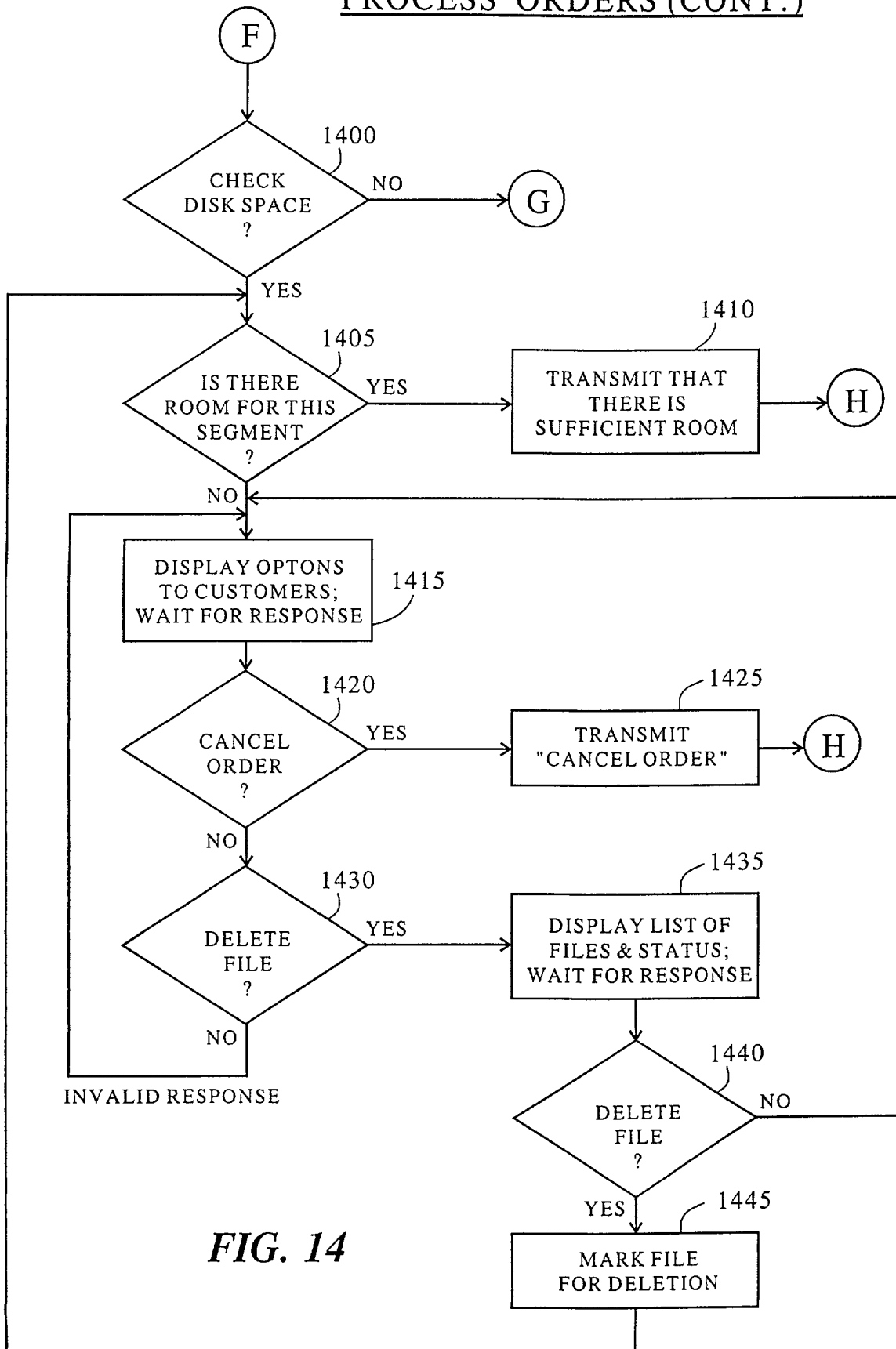


FIG. 12



PROCESS ORDERS (CONT.)**FIG. 14**

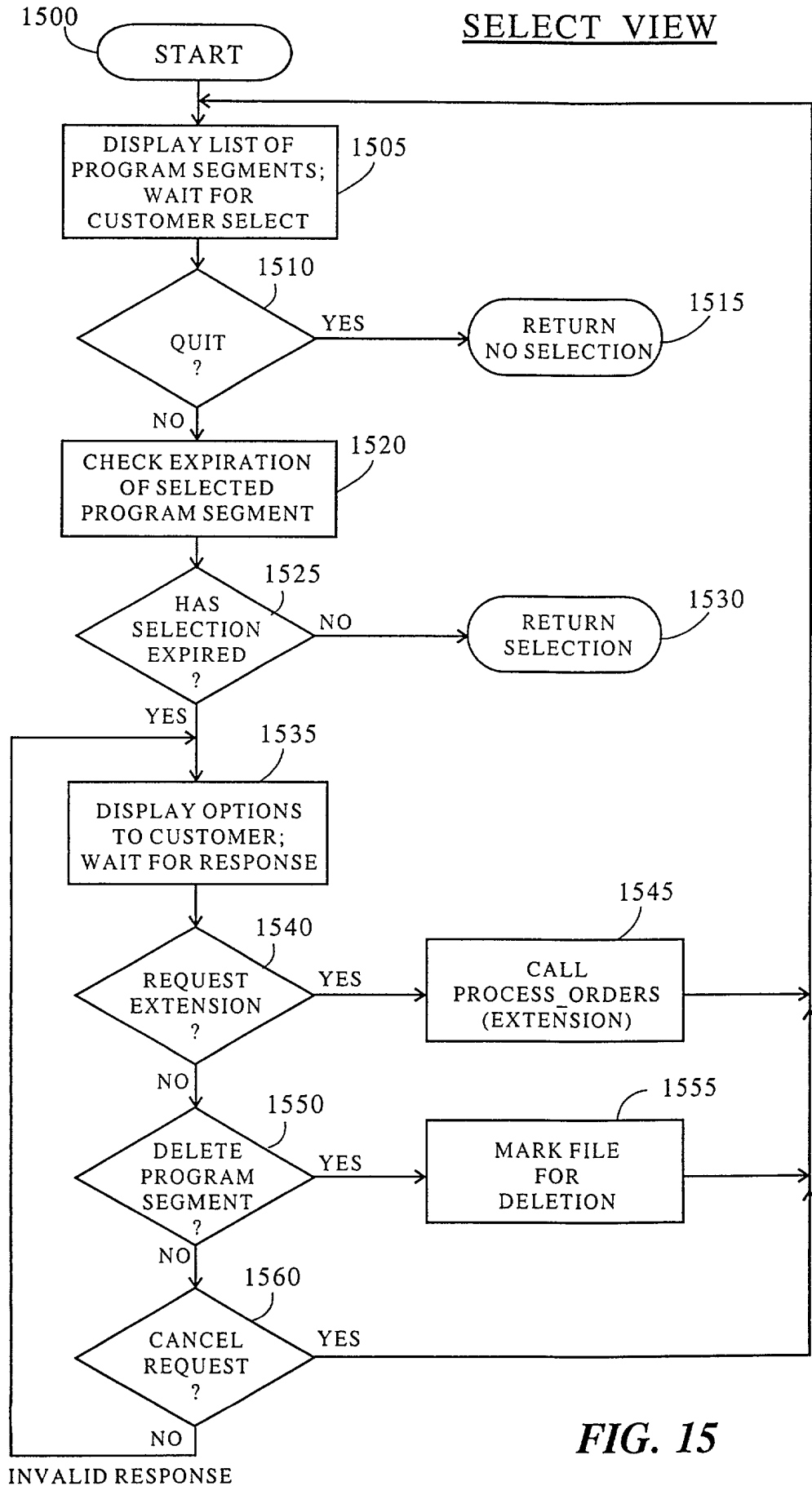
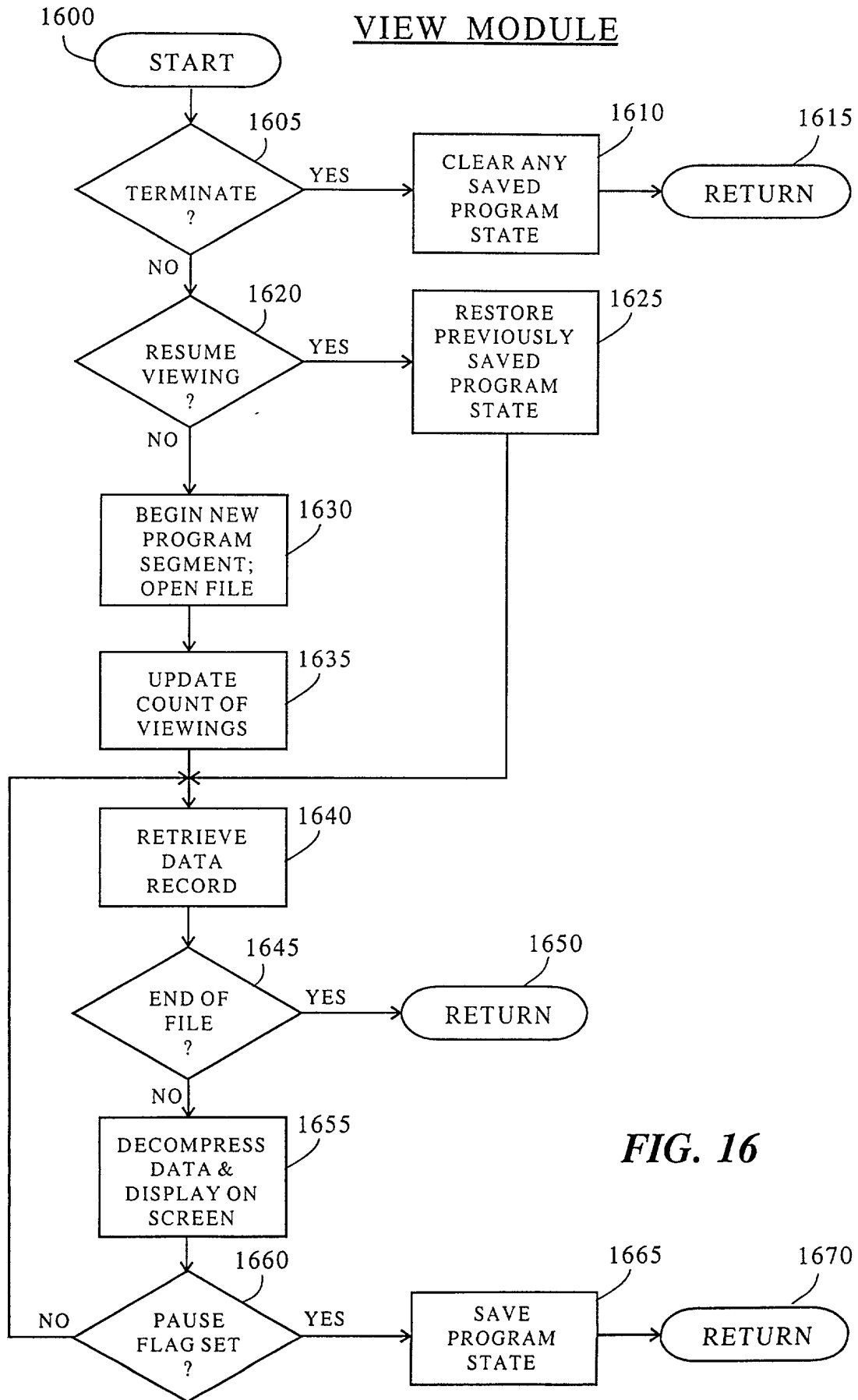


FIG. 15



## DECLARATION

AS A BELOW NAMED INVENTOR, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe that I am the original, first and sole (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below), of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**TITLE: INTERACTIVE AUDIOVISUAL DISTRIBUTION SYSTEM**

the specification of which either is attached hereto or indicates an attorney docket no. 8552-2 CON III, or:

☐ was filed in the U.S. Patent & Trademark Office on \_\_\_\_\_ and assigned Serial No. \_\_\_\_\_,

☐ and (if applicable) was amended on \_\_\_\_\_,

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability and to the examination of this application in accordance with Title 37 of the Code of Federal Regulations §1.56. I hereby claim foreign priority benefits under Title 35, U.S. Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, or §119(e) of any United States provisional application(s), listed below and have also identified below any foreign applications for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

**Priority Claimed:**

Yes [ ] No [ ]

\_\_\_\_\_  
(Application Number) (Country) (Day/Month/Year filed)

Yes [ ] No [ ]

\_\_\_\_\_  
(Application Number) (Country) (Day/Month/Year filed)

I hereby claim the benefit under Title 35, U.S. Code, §120, of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, U.S. Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, The Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

09/054,020 April 2, 1998 Pending  
(Application Serial Number) (Filing Date) (STATUS: patented, pending, abandoned)

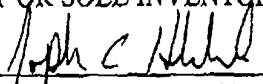
\_\_\_\_\_  
(Application Serial Number) (Filing Date) (STATUS: patented, pending, abandoned)

I hereby appoint the following attorneys: **FRANK CHAU**, Reg. No. 34,136; and **JAMES J. BITETTO**, Reg. No. 40,513; **FRANK V. DeROSA**, Reg. No. 43,584; and **GASPARE J. RANDAZZO**, Reg. No. 41,528, each of them of **F. CHAU & ASSOCIATES, LLP**, 1900 Hempstead Turnpike, Suite 501, East Meadow, New York 11554 to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith and with any divisional, continuation, continuation-in-part, reissue or re-examination application, with full power of appointment and with full power to substitute an associate attorney or agent, and to receive all patents which may issue thereon, and request that all correspondence be addressed to:

Frank Chau, Esq.  
F. CHAU & ASSOCIATES, LLP  
1900 Hempstead Turnpike, Suite 501  
East Meadow, New York 11554  
Area Code: 516-357-0091



I HEREBY DECLARE that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF FIRST OR SOLE INVENTOR: Joseph C. Haddad Citizenship U.S.A.  
Inventor's signature:  Date: 1/28/00  
Residence & Post Office Address: 140 Clover Lane, Elizabethtown, PA 17022

any person who makes a false statement in an affidavit or declaration made in connection with an application for a patent shall be liable to a fine of not more than \$500 or imprisonment for not more than six months, or both, for each such statement.